

SIEMENS

Printer PT 88/PT 89

User's Manual



**This User's Manual is valid for printers
as from Object Revision Level 7.**

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Quick reference guide

Code table

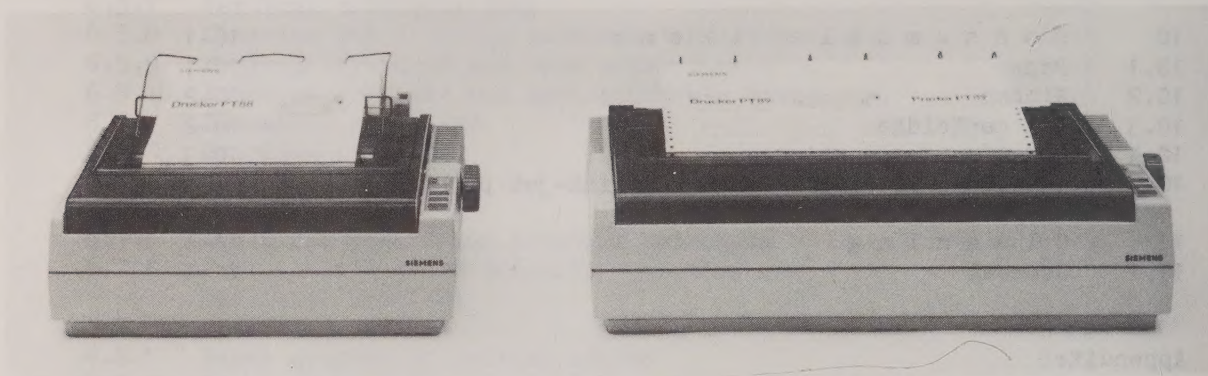


Fig. 0/1 Printer PT 88 with
roll paper

Fig. 0/2 Printer PT 89 with
fanfold paper

The Siemens PT 88 and PT 89 printers, two new-generation, high-performance additions to the familiar PT 80 matrix printer family, are the ideal choice for solving a wide variety of printing problems.

The PT 88 is a compact matrix printer of outstanding versatility. The PT 89 is also suitable for handling wider paper. The comprehensive range of functions is available in full for both the needle and the silent ink-jet version.

The microprocessor control techniques of the PT 88/PT 89 allow all important printer functions such as character sets, character and line spacing, expanded print, graphics, fillers steps etc. to be programmed via the interface. The flexible software concept permits problem-free expansion of functions by adding program modules on the plug-in expansion board (e.g. loadable character generator, scanner graphics).

The all-round flexibility of the printers is not confined to their electronic techniques. Both printers are designed, for instance, to handle fanfold paper and single sheets. The Printer PT 88 can also handle roll paper.

The PT 88/PT 89 are zero-maintenance units, which means that preventive measures such as oiling, greasing and the like are not required. It is however recommendable to observe the information on cleaning in section 11 and to clean the printer at regular intervals.

Comprehensive control measures during production and the 100% final test ensure that all printers are of the same high quality. A test certificate in the form of an original print sample made during the final test and enclosed with each printer offers proof of the quality of the PT 88/PT 89.

Please follow the unpacking instructions given in section 2 of this User's Manual. This will ensure that nothing goes wrong when the printer is placed in service.

As a check that your printer is working perfectly, the function test described in section 3 should be performed immediately after unpacking the printer. In the sections that then follow you will find all the information required for operating the printer and for optimally integrating it into your system.

If minor malfunctions occur during operation, please refer to section 9 for assistance. Should you however have major difficulties with your printer, you should simply contact your nearest field service office, where every effort will be made to repair your printer in the shortest possible time.

At the end of this description you will find the ordering data for the consumable items you will require.

We wish you every success with your Printer PT 88/PT 89.

Unpacking the printer

Open the carton and pull out the PT 88/PT 89 (including accessories and options) by the two packing moulds at the side, remove the packing material and check the following:

Contents

- check for visible shipping damage and
- check for completeness as per delivery note.

Basic configuration

- Printer PT 88/PT 89
- Ribbon cartridge
(for needle printer)
- Paper deflecting frame

The ink cartridge is already installed in the ink-jet printer.

Options

- User's Manual
- Memory expansion module (SPE)
- Function expansion module
- Interface adapter module (SAP)
- Power cable
- Data cable
- Paper roll holder (only for PT 88)

- Check that the serial numbers on the delivery note and on the voltage rating plate of the printer correspond.

Important notes:

- As the printer can only be shipped safely in its original packaging, all parts of the packaging should be retained for possible reshipment.
- Before reshipment, the container on the ink-jet print head (below the ink cartridge) must be wiped clean of ink. The ink cartridge must be removed beforehand.

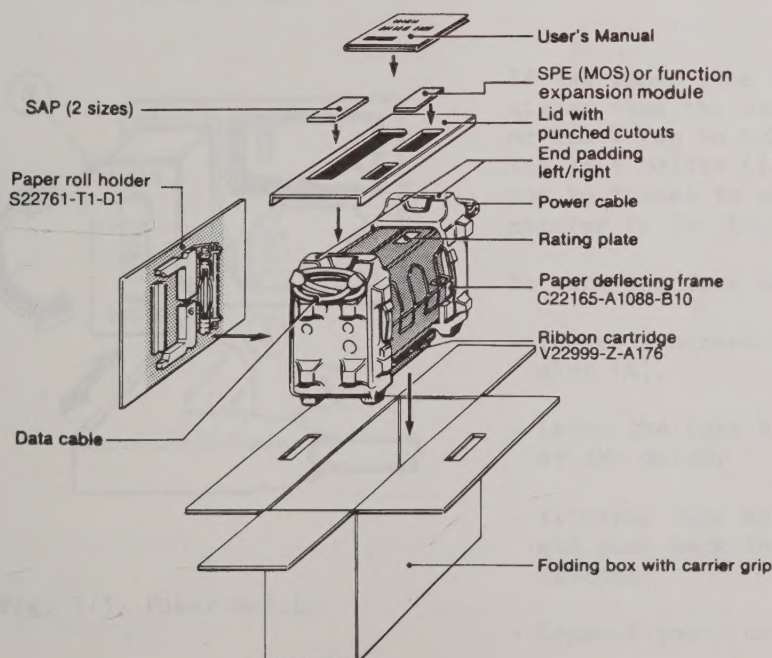
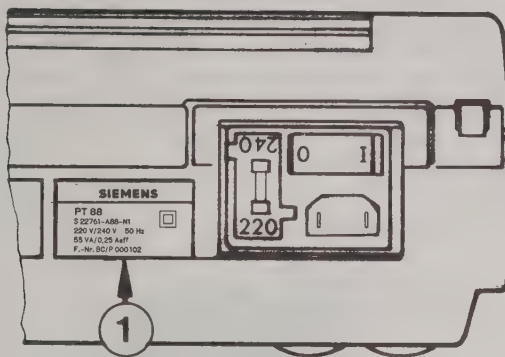


Fig. 2/1 Schematic representation of the packaging

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3 Placing the printer in service and function test

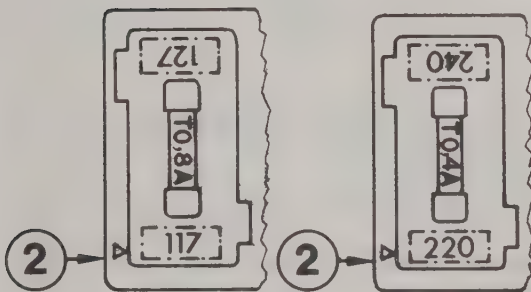
3.1 Placing the printer in service



Important note:

Check that the line voltage on the rating plate (1, Fig 3/1) corresponds with the local line voltage.

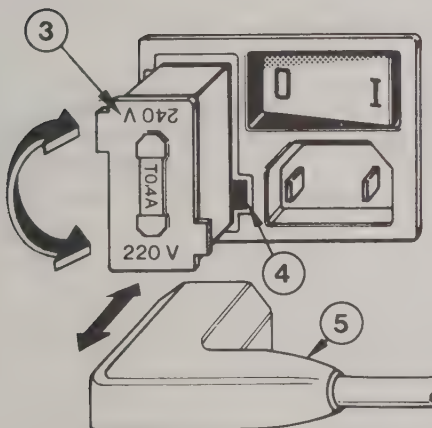
Fig. 3/1 Rear view of PT 88



The printer is supplied in one of the two versions shown (117 V/220 V).

The voltage indicated by the marker (2, Fig. 3/2) applies.

Fig. 3/2 Marker on fuse holder



If the local line voltage is higher than the standard 117 V or 220 V (up to 127 V or 240 V), the fuse holder (3, Fig. 3/3) can be turned to adapt the printer to the local conditions.

To turn the fuse holder:

- Insert a screwdriver in slot (4).
- Lever the fuse holder out of the catch.
- Withdraw fuse holder, turn and push back in until it latches.
- Connect power cable (5).

Fig. 3/3. Power module

Version with needle printing mechanism:

- Load ribbon (see section 5.6.2).

Version with ink-jet printing mechanism:

- Remove the transport clip for the print head from the clamp (1, Fig. 3/4) and fix it to the holder on the side plate (2, Fig. 3/5). The transport clip is thus immediately accessible for reshipment. If the transport clip is made of Styropor, it need not be removed.

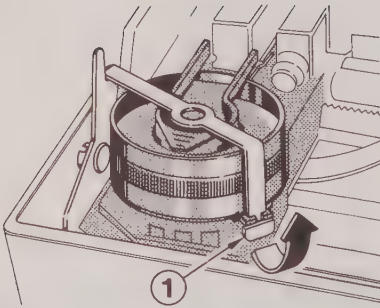


Fig. 3/4 Transport clip for ink-jet print head

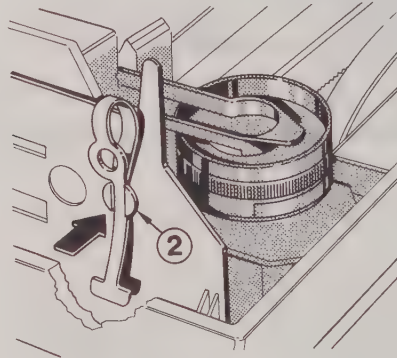


Fig. 3/5 Holder for transport clip

- Load paper (see section 5.5).



- Switch on power at power switch.
(The power switch is at the back of the printer.)

All three displays on the manual control device (Fig. 3/6) are illuminated briefly.

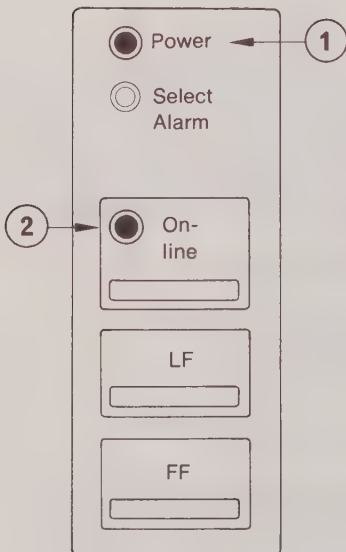
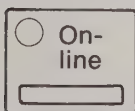


Fig. 3/6 Manual control device

When the PT 88/PT 89 is ready to operate (with the ink-jet printer after 10 s = typical value at room temperature), only the POWER (1, Fig. 3/6) and ON-LINE (2) displays remain illuminated.

3.2 Function test - controls

It is not necessary to connect the data cable for the following test steps:



ON-LINE/OFF-LINE

Press pushbutton:

Printer goes to the OFF-LINE operating mode.
ON-LINE display is not illuminated.

Press pushbutton again:

Printer returns to the ON-LINE operating mode.
ON-LINE display is illuminated.



LINE FEED

(Only effective in OFF-LINE operating mode.)

Press pushbutton briefly:

Paper is advanced one step in accordance with the line spacing selected on coding switch (factory setting 1/6").

Hold pushbutton down:

Paper is advanced as long as pushbutton is held down.

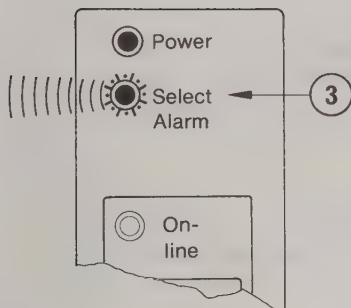


FORM-FEED

(Only effective in OFF-LINE operating mode.)

Press pushbutton:

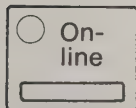
Form feed to 1st line of the next form. The single sheet is fed until it can be removed manually.



ALARM

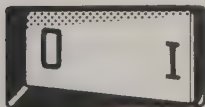
The ALARM display (3, Fig. 3/7) flashes in the end-of-paper condition and an audible alarm sounds at the same time. The audible alarm sounds for approximately 25 s and is then automatically switched off. When paper is again loaded, the display also stops flashing.

Fig. 3/7 Manual control device



ON-LINE/OFF-LINE

By pressing the pushbutton, the audible alarm can be switched off immediately.



Switch off power at power switch.

3.3 Function test - printer

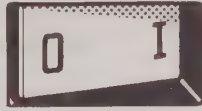
Load paper and advance to the tear-off edge (see also section 5.5). With single sheets or fanfold paper, the paper format used must correspond to the form length set on the coding switch (section 4.3).

Test mode activation

Condition: the printer must be switched off.



+



Switch on power while holding the LF pushbutton down.
(With the ink-jet printer, the ink nozzles are automatically enabled.)
Release LF pushbutton.

The character set of the character generator selected at this time is printed. Each new line begins with the 2nd character of the preceding line.

```
+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`abcdefghijklmnop  
,-/0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`abcdefghijklmnop  
-/0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`abcdefghijklmnopq  
./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`abcdefghijklmnopqr  
/0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs  
0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`abcdefghijklmnopqrst  
123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`abcdefghijklmnoprstu  
23456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`abcdefghijklmnoprstuv
```

The line length is limited to 69 characters/line in the test mode.
After every 50 lines automatic form feed takes place. This prevents printing across the paper perforation.

Test stop



Press the FF pushbutton until the printing operation is interrupted at the end of a line.

Test continuation



Press the LF pushbutton:
The printing operation is continued.

Test mode deactivation



Switch off power at power switch.
(With the ink-jet printer, the ink nozzles are automatically closed.)

Fault condition in test mode (e.g. end of paper)

If a fault occurs during the test mode, proceed as follows:

- The ALARM display flashes and audible alarm sounds.
- Press the ON-LINE pushbutton. Audible alarm is silenced.
- Eliminate fault (e.g. load paper; see section 9.1 if necessary).
- Press the LF pushbutton. The printing operation is continued.

4 Installation of the printer

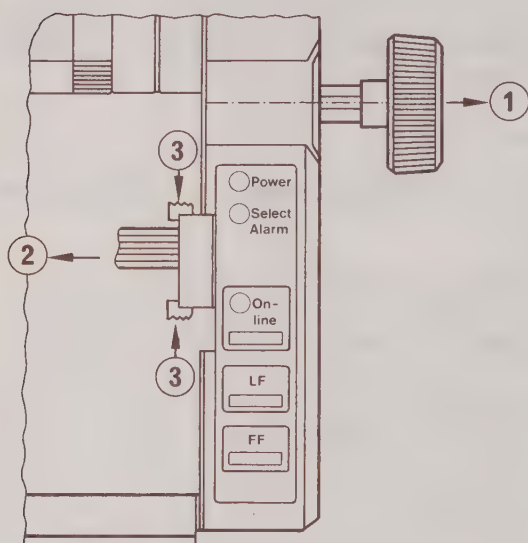
To ready the PT 88/PT 89 for actual operation, proceed in the order shown below, with the power cable pulled:

- Remove top cover (see section 4.1).
- Select functions on the interface adapter module SAP with the coding switches (section 7.1.5 or 7.2.5). Insert interface adapter module and (if provided) memory expansion or function expansion module SPE in printer (see section 4.2).
- Replace top cover (see section 4.1).
- Select function variants on the central control (ZS) with coding switches (see section 4.3).
- Connect power and data cables (see sections 3.1 and 4.4).
- Mount paper deflecting frame (see section 4.5).
- For operation with roll paper:
assemble and install roll holder (see section 4.6).
- Load paper (see section 5.5).

4.1 Removal of the top cover

The top cover is held by two catches inside the cover at the front and is attached to the base tray at the rear via a form-fit fastening.

Sequence of removal



Pull off platen thumbwheel (1, Fig. 4/1a).

Swing upward front cover lid.

Break plug connection to manual control device (2). The connector must be held by the clips (3).

Apply pressure to the two spring clips (4, Fig. 4/1b) to release top cover and swing it to the rear over the lugs of the fastening (5).

The top cover is replaced in the reverse order of removal.

Fig. 4/1a Removal of the platen thumbwheel

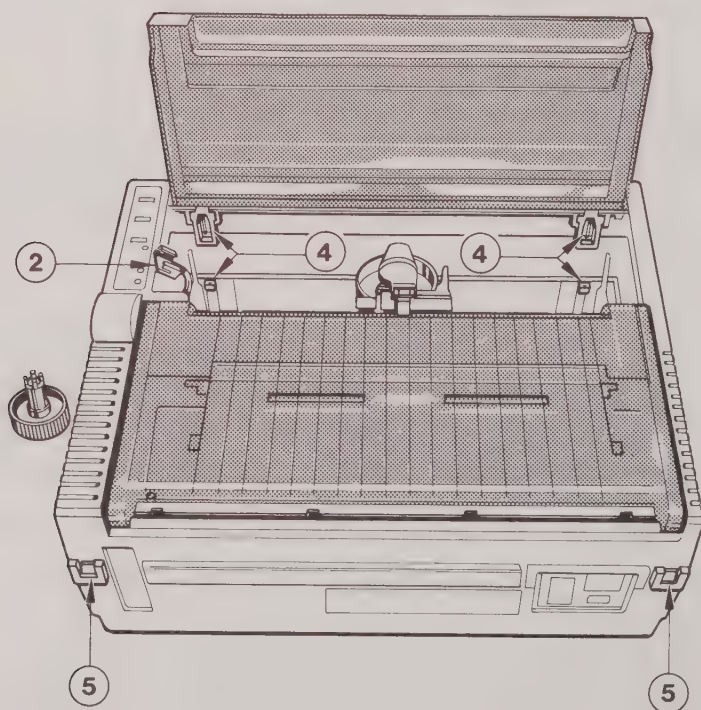


Fig. 4/1b Removal of the top cover

4.2 Installation of the interface adapter module and/or memory expansion or function expansion module (option)

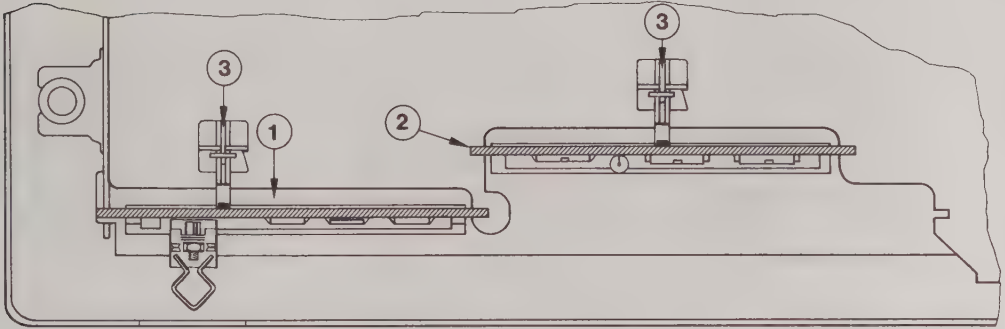


Fig. 4/2 Mounting position for interface adapter module (1) and the memory expansion module or function expansion module (2)
(figure shows rear of printer seen from above)

- Select desired functions with the coding switches on the interface adapter module (see section 7).
No settings need be changed for the Centronics® interface.
- Center interface adapter module via lugs.
- Unlatch centering lug (3, Fig. 4/2).
- Press board into connector.
- Release centering lug (latches automatically).

If a memory expansion module SPE is provided, it can be installed in the same manner as the interface adapter module.

The printer can also be converted easily to a different interface by exchanging the interface adapter board.

4.3 Coding switch settings

The coding switch is located under the cover on the central control ZS (Fig. 4/3). Access to the coding switch is obtained by opening the front cover lid. The factory setting is shown in Fig. 4/4.

Certain standard functions and the desired character set can be selected with the coding switch (Fig. 4/5). The coding switch combinations selected are read in by the control in response to "Power ON" or "Input prime". Changing the switch setting in the activated condition of the printer has no effect. On reception of the commands "Reset printer to initial status" or "Reset parameters", the initial status defined when power is applied is obtained.

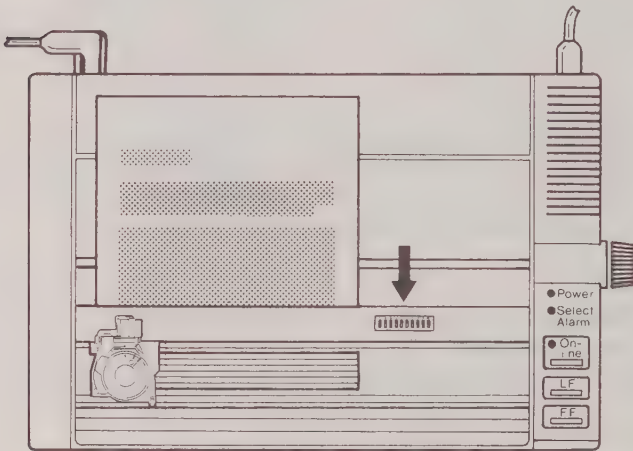


Fig. 4/3 Position of the coding switch

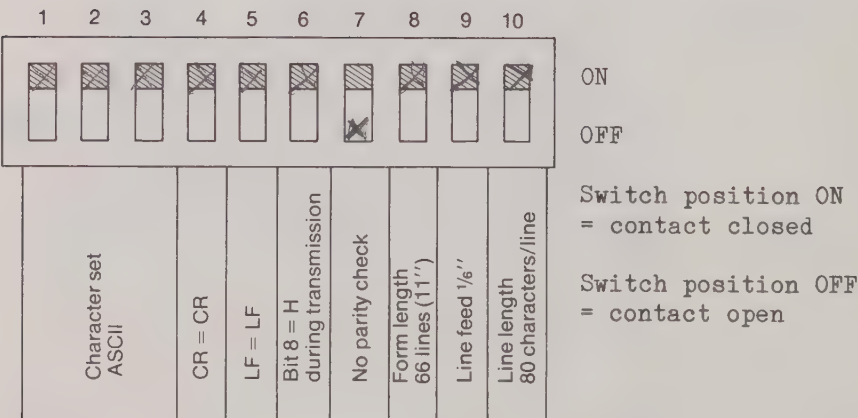


Fig. 4/4 Factory setting of the coding switch

Coding switch setting:

● = ON; ○ = OFF

Switch 1 2 3	Character sets, special characters												
● ● ●	ASCII	#	\$	@	[	\	]	^	`	{		}	~
● ● ○	S/SF	§	¤	É	Ä	Ö	Å	^	é	ä	ö	å	ü
● ○ ●	GB	£	\$	@	[	\	]	^	`	{		}	~
● ○ ○	E	#	\$	@	i	ñ	¿	^	`	´	ñ	ç	¨
○ ● ●	IA Nr.5	#	¤	@	[	\	]	^	`	{		}	~
○ ● ○	D	#	\$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
○ ○ ●	DK/N	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
○ ○ ○	F/B	£	\$	à	°	ç	§	^	`	é	ù	è	¨

Switch	ON	OFF	Remarks
4	LF = LF	LF = CR + LF	Paper movement
5	CR = CR	CR = CR + LF	
6	even (no parity: bit 8 = H for trans- mission	odd (no parity: bit 8 = L for trans- mission	Parity
7	off	on	
8	11"	12"	Form length
9	1/6"	1/8"	Line feed
10	PT 88	PT 89	Printing width

Fig. 4/5 Defined switch settings of the coding switch

4.4 Connection of the data cable and the power cable

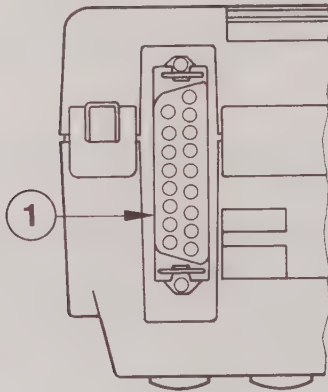


Fig. 4/6 Interface connector

When the interface adapter module SAP has been installed, the interface connector (1, Fig. 4/6) on the board can be seen at the rear of the printer. The connector is one of the following:

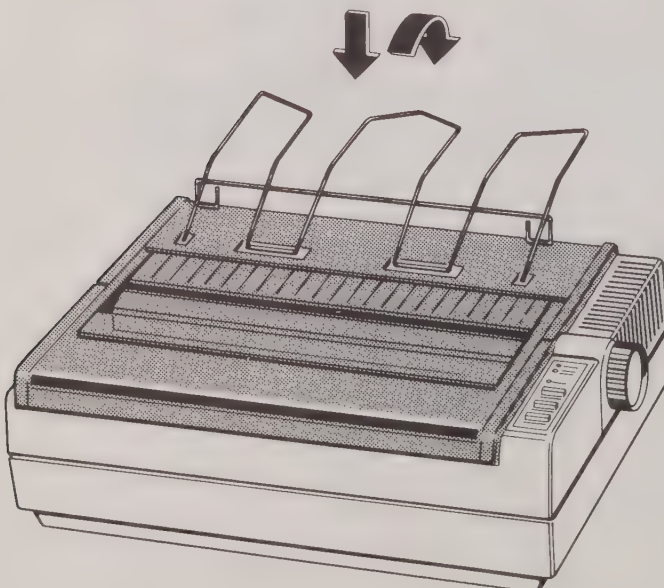
Serial interface:	25-pin Cannon® female contact strip V.24/V.28 or R-232-C	} see section 7
Serial interface:	25-pin Cannon® female contact strip TTY, current loop	
Parallel interface:	36-pin Amphenol® female contact strip Centronics	

Standard data cables are available for the connection of the printer to the transmitting station. They are given in the relevant accessory list (or corresponding data sheets).

Connect the data cable to the interface connector.

Connect the power cable (see section 3.1).

4.5 Installation of the paper deflecting frame



The paper deflecting frame is inserted vertically into the guide holes of the rear cover lid and then swung backward (Fig. 4/7). For insertion, the two outer arms must be pulled slightly apart.

Fig. 4/7
Paper deflecting frame

4.6 Assembly and installation of the paper roll holder
(only for the PT 88)

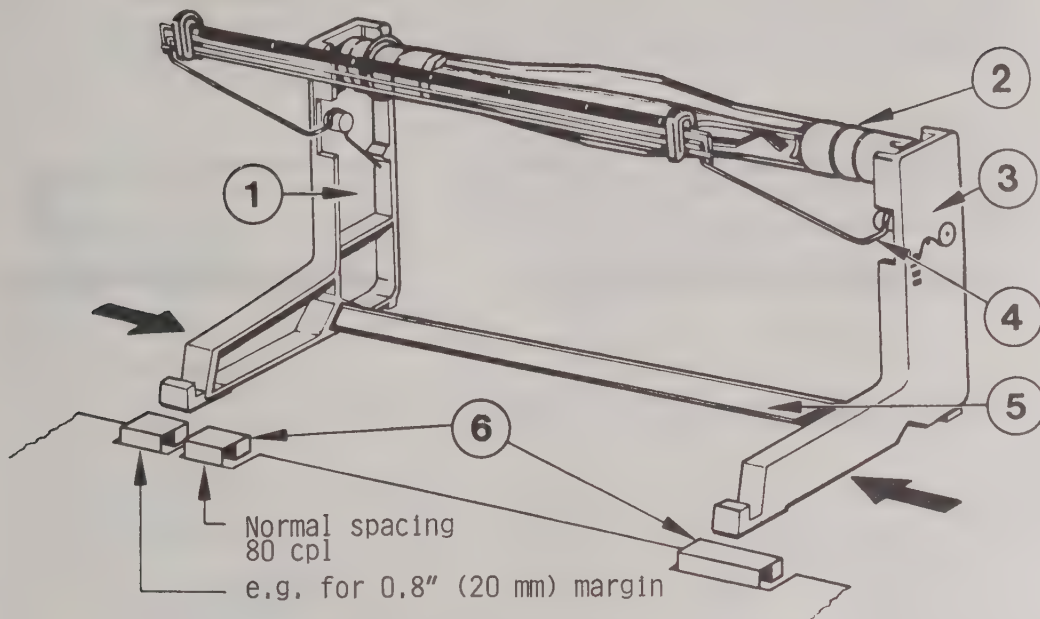
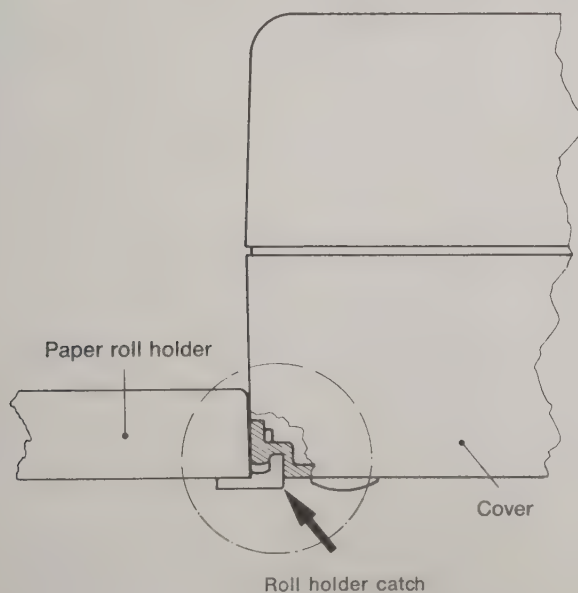


Fig. 4/8 Component parts of the paper roll holder

- Push the lateral supports (1 and 3, Fig. 4/8) of the roll holder as far as they will go onto the spacing bar (5).
- Hook pull relief rod (4) over the protrusion on the inside of the supports.
- Set paper roll axle (2) from above into the slots of the two supports. (Observe guide groove in left-hand support.)
- Lift up rear of printer slightly and insert the preassembled paper roll holder - below the printer - into the associated slots (6).



Note:

When installing the paper roll holder, ensure that the power and data cables are not impeded.

Fig. 4/9
Insertion of the paper roll holder

4.7 Installation requirements

For operation with roll or fanfold paper, the printer should be set up as shown in the following figures. The area required by the printer is shown in Figs. 4/10 and 4/11.

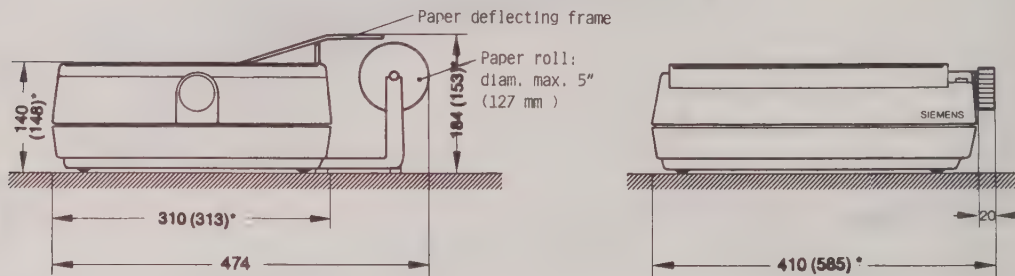
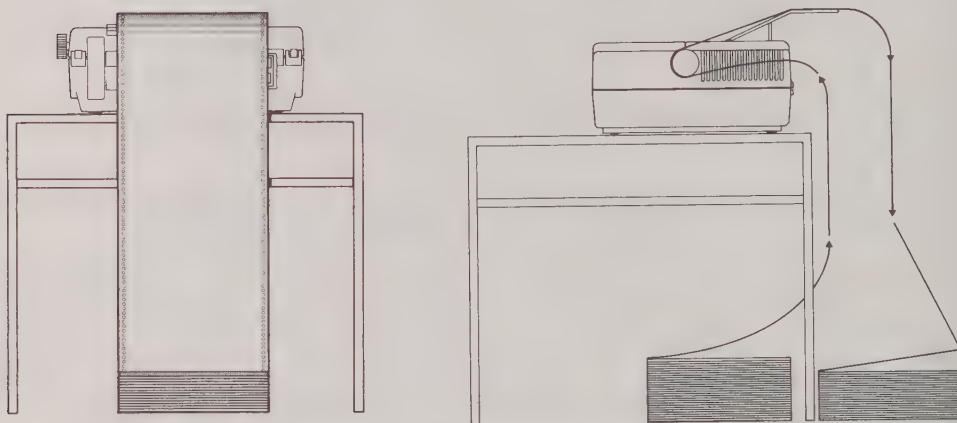


Fig. 4/10 Operation with roll paper



* The dimensions in brackets are for the wide version of the printer (PT 89). This printer is not suitable for roll paper.

Fig. 4/11 Operation with fanfold paper

5 O p e r a t i o n o f t h e p r i n t e r

5.1 Power switch

The power switch is located at the rear of the printer directly above the device connector.

When the printer is switched on, the "POWER" display signals the "Power ON" status. The "SELECT" and "ON-LINE" displays are illuminated briefly. The printer carriage is synchronized and is positioned at the start-of-line contact on the left-hand side. The printer then assumes a status as follows:

- . ON-LINE (ON-LINE display illuminated)
if the printer is ready to operate (see section 5.2) or
- . FAULT (ALARM display flashes)
if the printer is not ready to operate (see section 5.2)

The ON-LINE or FAULT status is signaled a few seconds after the power has been switched on (typical time 10 s) with the ink-jet printer when the ink nozzles have warmed up.

Important note:

When the printer is switched off, all parameters programmed by means of control characters, the contents of character generators and data in the receive buffer are deleted.

5.2 Control functions and displays

Manual control device

The manual control device (Fig. 5/1) is installed in the upper section of the printer cover and is used to display the operating status and to initiate local printer functions via pushbuttons.

Displays

POWER display (1)

Display illuminated

The printer is switched on and the required supply voltage is available.

SELECT/ALARM display (2)

Display illuminated

Data are present in the receive buffer. Data are only printed in the ON-LINE mode.

Display not illuminated

Receive buffer contains no data.

Display flashes

A fault has occurred; the ON-LINE display goes dark. The ALARM display flashes to indicate:

- End of paper.
- End of ink.

With these faults the line being printed is completed and the printout is interrupted. Information in the receive buffer is not deleted. After elimination of the fault (paper loaded, ink cartridge replaced) and resetting to the ON-LINE mode, the rest of the buffer contents is printed out.

- Other faults.

The line is not necessarily completed.

Proceed with fault elimination as per section 9. Note that data can be lost under unfavorable circumstances.

Display continues to flash in the OFF-LINE mode with positive seal open (= washing-out position for 3 minutes max.). Important: No ink cartridge or paper replacement in this position (see section 9.2).

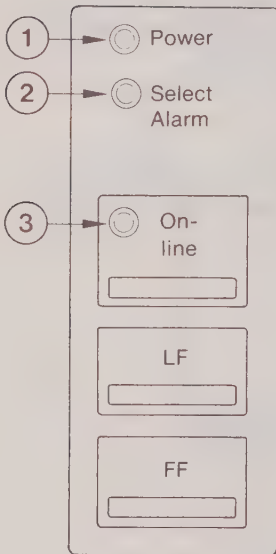


Fig. 5/1
Manual control device

ON-LINE/OFF-LINE display (3)

Display illuminated (= ON-LINE mode)

The printer is ready to operate. The local button functions for paper feed are disabled.

Display not illuminated (= OFF-LINE mode)

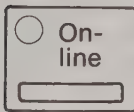
The printer is not ready for operation. Printing is interrupted (except in the test mode). Information in the receive buffer is retained (SELECT display illuminated). All control pushbuttons are enabled.

Pushbutton functions

Pushbutton

Function

ON-LINE/
OFF-LINE



ON-LINE/OFF-LINE pushbutton

When this pushbutton is actuated in the ON-LINE mode, the printer is switched to the OFF-LINE mode. A line being printed out is completed and printing is interrupted. The ON-LINE display goes dark.

When this pushbutton is actuated in the OFF-LINE mode, the printer is switched back to the ON-LINE mode, the printer carriage being synchronized. The ON-LINE display is illuminated. Information in the buffer is printed out.

When this pushbutton is actuated in the FAULT status, the audible alarm is silenced. The ALARM display continues to flash.

LINE FEED



LINE FEED pushbutton (only effective in OFF-LINE mode; see section 3.3 for function in test mode)

Pushbutton
pressed briefly

Paper is fed one step in accordance with line spacing set or programmed.

Pushbutton held
down

Paper is fed as long as pushbutton is held down. When the pushbutton is released, the paper feed is terminated with adherence to the line spacing set or programmed.

FORM FEED



FORM FEED pushbutton (only effective in OFF-LINE mode; see section 3.3 for function in test mode)

Actuation of this pushbutton causes the form to be fed to the next top-of-form position (see section 5.5.1) in accordance with the form length set or programmed). The paper must have been loaded with adherence to the instructions in the following.

Simultaneous actuation of the ON-LINE and FF pushbuttons permits the ink-jet print head to be washed out (see section 9.2).

5.3 Further displays and functions

5.3.1 Audible alarm

The audible alarm is tripped together with the visual alarm (ALARM display flashes) when a fault occurs. Duration approx. 25 s. It can however be disabled by actuating the ON-LINE push-button.

Reception of the control character BEL causes a short audible signal to sound.

5.3.2 End-of-paper contact

End of paper is signaled five lines (with 1/6" line spacing) before the end of the sheet. The rest of the sheet cannot be printed. If the paper is removed manually before "End-of-paper" is signaled, the printer must always be switched to the OFF-LINE mode beforehand.

Note: If the paper is removed in the ON-LINE mode, there is the danger that newly arriving data causes printing on the platen.

5.3.3 Positive seal

The ink-jet printing mechanism is provided with a positive seal to close off the nozzle orifices. This seal prevents the ink from escaping during shipment and from drying up at the nozzle orifices.

The seal is opened:

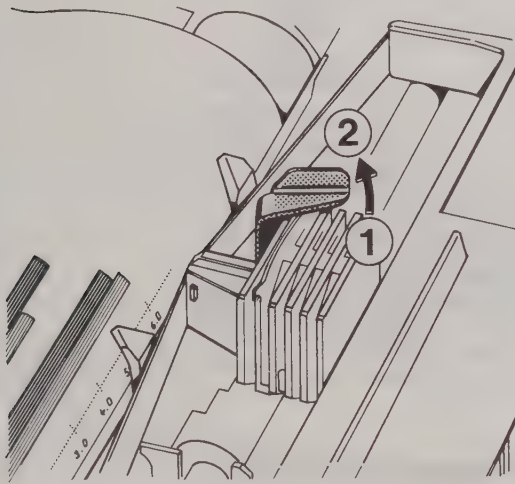
- automatically before the printing operation starts in the ON-LINE mode
- for washing out after actuation of pushbuttons FF and ON-LINE for three minutes or in the test mode (see section 9.2).

The seal is closed automatically:

- in response to "Power OFF"
- during printing intervals lasting longer than 3 minutes
- in the fault condition
- in the OFF-LINE mode
- after three minutes in the OFF-LINE mode subsequent to being opened for washing out.

5.4 Adjustment of the print impact in the needle printer

The gap between the needle print head and the platen is variable for single-part or multiple-part paper. The print impact required is selected with the lever located above the needle print head, which is latched in one of two positions (see Fig. 5/2).



Position 1:
larger gap with
multiple-part paper

Position 2:
smaller gap with
single-part paper

Fig. 5/2 Needle print head

5.5 Loading paper

5.5.1 Top-of-form position (TOF)

When the printer is switched on (also after a power outage), the current position of the paper is fixed as the top-of-form position. The top-of-form position defines the position of the first print line on the form and is used as initial position for form control by means of FF, VT and first and last programmed line.

On insertion, the paper must be shifted with the thumbwheel until the required top-of-form position is reached (first line to be printed is in front of the print head).

When the top edge of the paper and the tear-off edge are aligned, the space between the upper edge of the sheet and the first print line is 8/6" increments.

If printing is to start at the top-of-form position again after paper replenishment, initiate a form feed via the FORM FEED push-button after loading the paper and advance the paper with the platen thumbwheel to the required starting position.

5.5.2 Loading single sheets

Single sheets can be loaded into the Printers PT 88 and PT 89 just as easily as a typewriter.

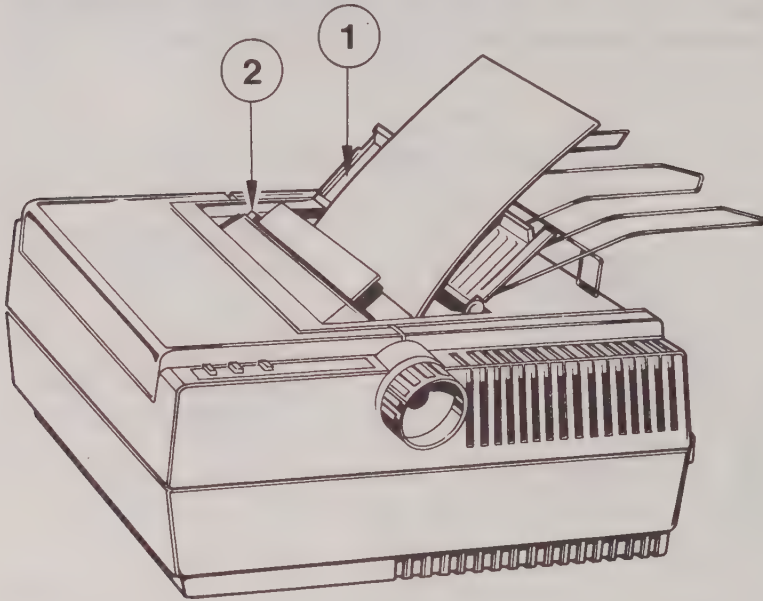


Fig. 5/3 Single sheet insertion

- Raise lid for single sheets (1, Fig. 5/3).
- Press paper pressure arm (2) to the front.
- Insert the sheet down behind the platen until turning the thumbwheel by hand draws in the sheet (see Fig. 5/4).
- Press paper pressure arm (2) to the rear and align the sheet. Arrow on printer marks the position of the first print column on the left-hand side.
- Press paper pressure arm to the front.
- Bring sheet to top-of-form position (see section 5.5.3).

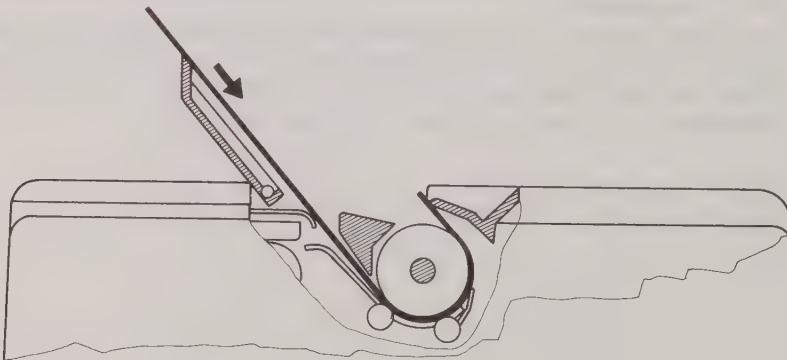


Fig. 5/4 Paper path - single sheets

5.5.3 Loading fanfold paper

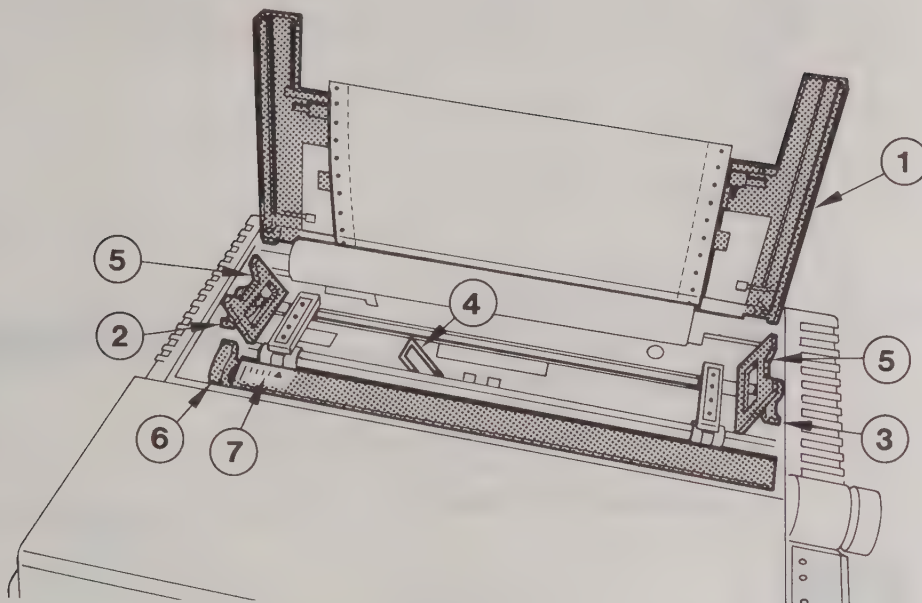


Fig. 5/5 Fanfold paper insertion

- Raise rear cover lid (1, Fig. 5/5).
- Release the two tractors with the levers (2 and 3).
- Swing pressure lever (4, only for PT 88) to the left into down position. (Increased pressure of friction rollers is removed.)
- Open the two tractor flaps (5).
- Feed the paper from the rear under the cover lid (1) and index the margin perforations with the tractor pins. The top edge of the paper should protrude beyond the guide plate (1, Fig. 5/6).
- Close tractor flaps (5, Fig. 5/5).
- Draw in paper by rolling the thumbwheel.
- Press paper pressure arm (6) to the rear so that the paper can be shifted laterally.
- Shift paper to the required position for starting printing. The arrow (7) on the printer marks the position of the first print column on the left-hand side.
- Important: Now fix the position of the two tractors (2 and 3).
- Press paper pressure arm (6) to the front.
- Close cover lid.
- Align paper stack with respect to the printer (Figs. 5/7, 5/8).
- Set form to top-of-form position.

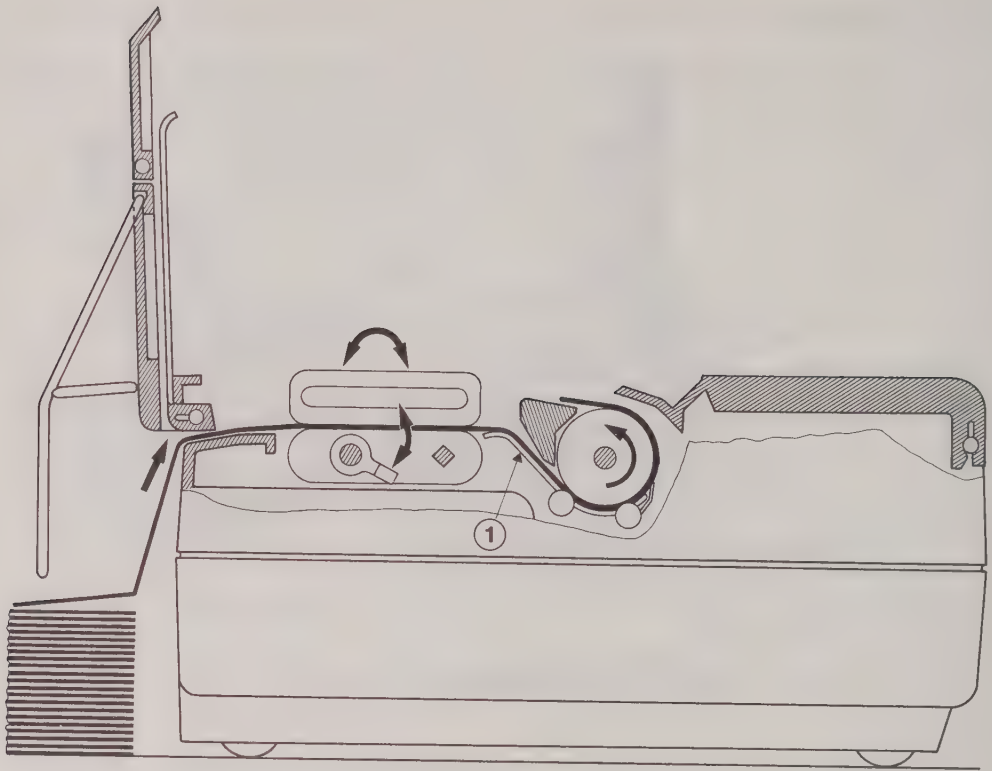


Fig. 5/6 Fanfold paper insertion

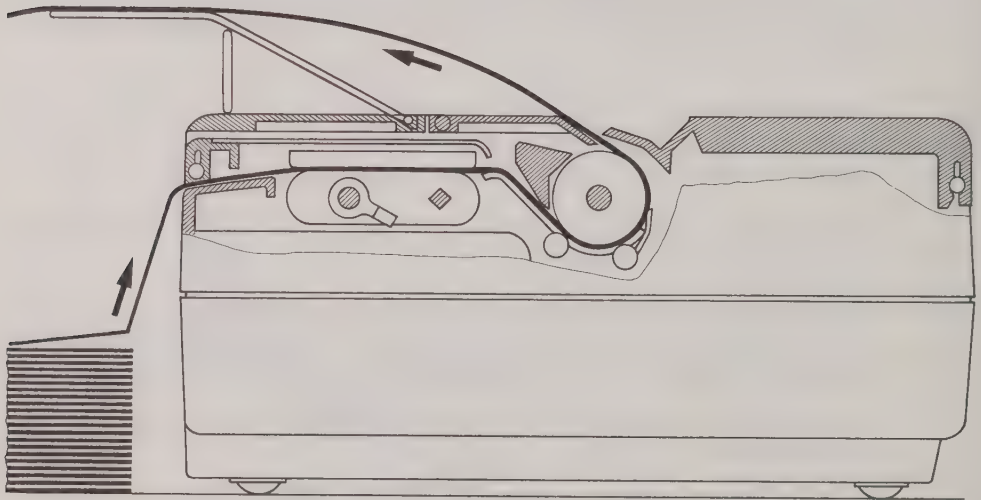


Fig. 5/7 Fanfold paper path

5.5.4 Loading roll paper (only for PT 88)

- Push the paper roll onto the axle of the paper roll holder as far as the stop.
- Place paper roll in paper roll holder (stop on left, with guide groove).
- Guide paper as shown on the roll holder (Fig. 5/8) over the pull relief rod.
- Position guide clamps on the pull relief rod (1, Fig. 5/9) so that they come within 0.04" (1 mm) of each side of the paper.

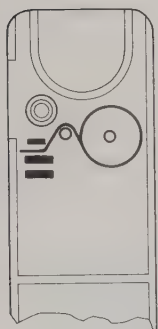


Fig. 5/8 Roll paper path shown on the lateral supports of the paper roll holder.

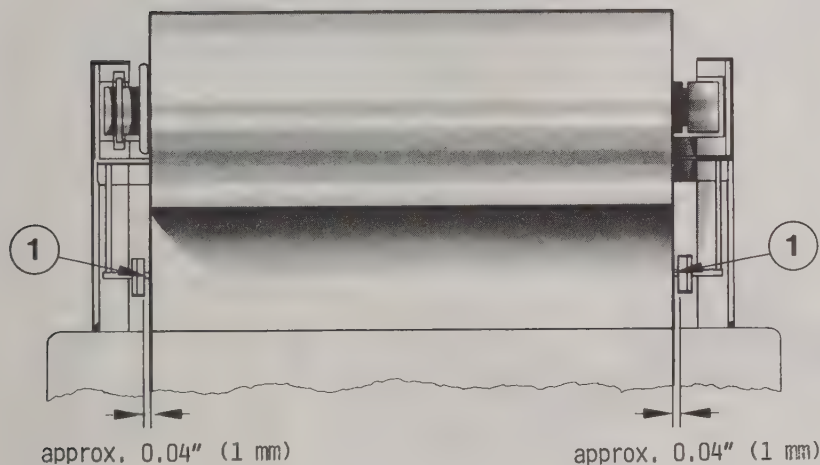


Fig. 5/9 Gap for guide clamps

- With narrow paper, withdraw right-hand guide clamp (1, Fig. 5/10) and position it between guiding rollers (2) in accordance with new paper width.

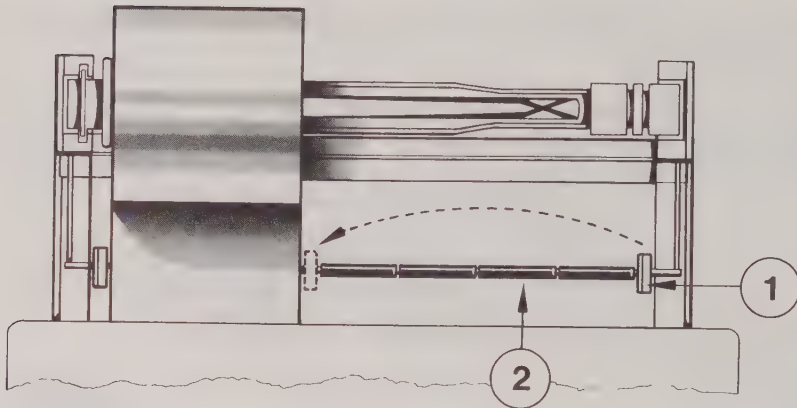


Fig. 5/10 Rearrangement of the guide clamps

To ensure trouble-free operation with multi-part roll paper, fan the copies (1, Fig. 5/11) over the pull relief rod (2). When carbon paper is used, the coated side of the carbon paper must always be separated from the next layer.

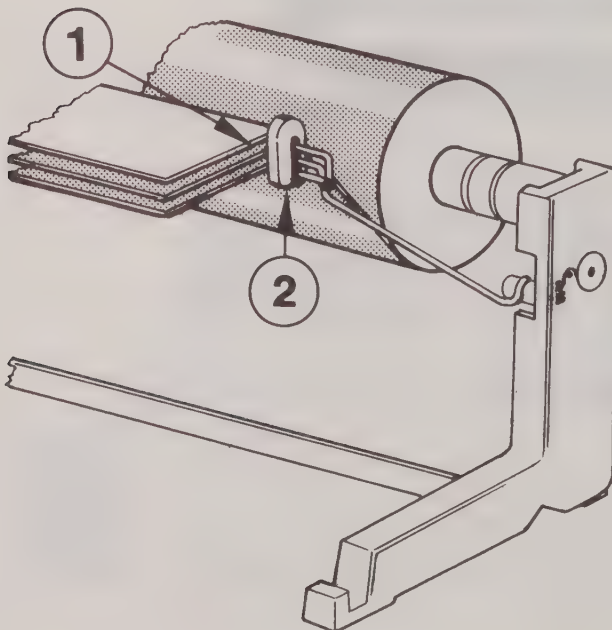


Fig. 5/11 Paper path with multi-part paper

Entry, passage and exit of roll paper

Important: The pressure lever (4, Fig. 5/5) between the tractor guide bars must be raised. The friction roller pressure is thus increased for operation with roll paper.

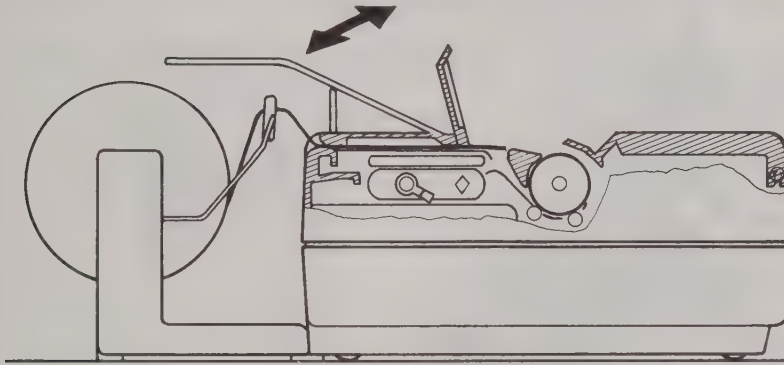


Fig. 5/12a

- Raise lid for single sheets.
- Lift paper deflecting frame and feed paper into upper channel as far as the guide plate (Fig. 5/12a).

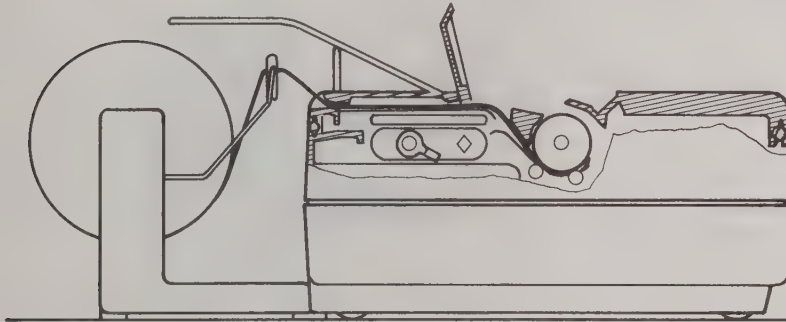


Fig. 5/12b

- Deflect paper downward manually and advance paper round platen with thumbwheel (Fig. 5/12b).

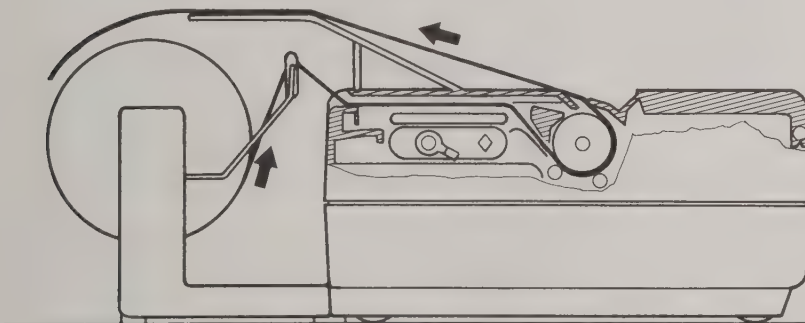


Fig. 5/12c

- Press paper pressure arm (6, Fig. 5/5) to the rear.
- Align paper.
- Press paper pressure arm to the front.
- Close lid for single sheets (Fig. 5/12c).

5.5.5 Tearing off the paper

A knife-type tear-off edge is provided for tearing off the paper. The paper can thus be torn off at any point.

The paper should be torn off "diagonally" with respect to the tear-off edge (Fig. 5/13).

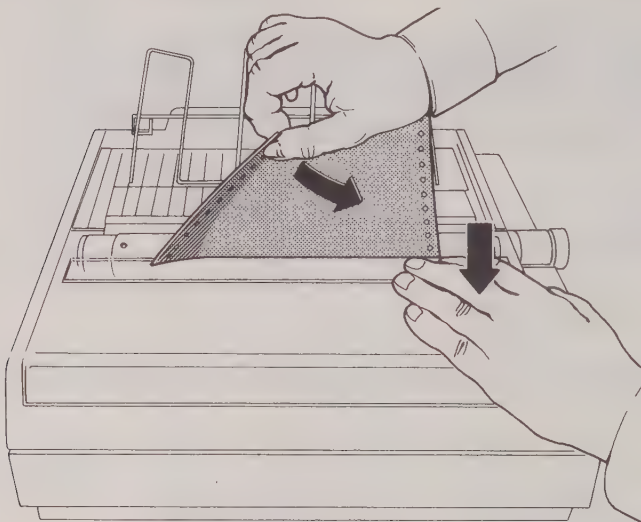
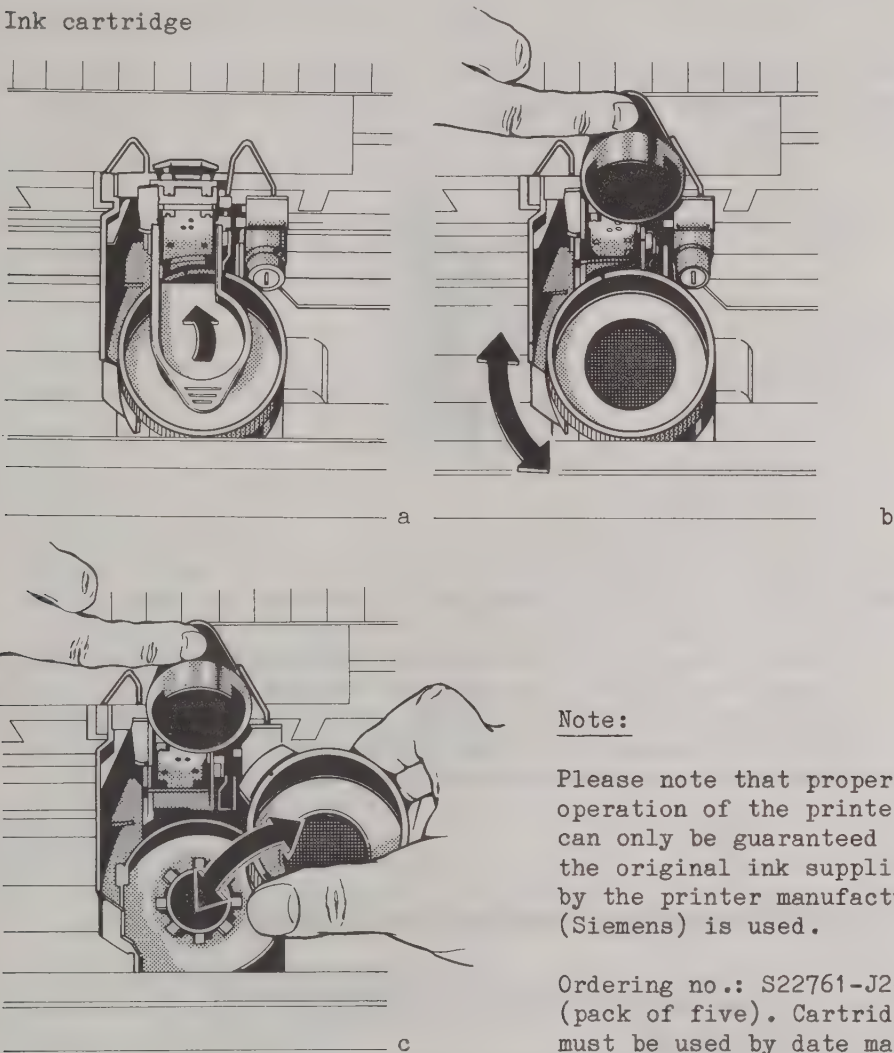


Fig. 5/13 Tearing off the paper

5.6 Replacement of the ink and ribbon cartridges

5.6.1 Ink cartridge



Note:

Please note that proper operation of the printer can only be guaranteed if the original ink supplied by the printer manufacturer (Siemens) is used.

Ordering no.: S22761-J2-D1 (pack of five). Cartridges must be used by date marked on package.

Fig. 5/14 a-c Installation/removal of the ink cartridge

- Open front cover lid.
- Raise lid (Fig. 5/14a) and hold in position shown (Fig. 5/14b).
- Unlatch ink cartridge by turning it to the left (Fig. 5/14b) and lift up and out (Fig. 5/14c).
- Insert new ink cartridge and turn it to the right into the operating position.
- Release lid (returns to home position under spring loading).

Do not leave the printer with the ink cartridge removed, as this can lead to operational malfunctions.

The ink cartridge need not be removed for shipment of the printer as the nozzle orifices are automatically sealed.

5.6.2 Ribbon cartridge

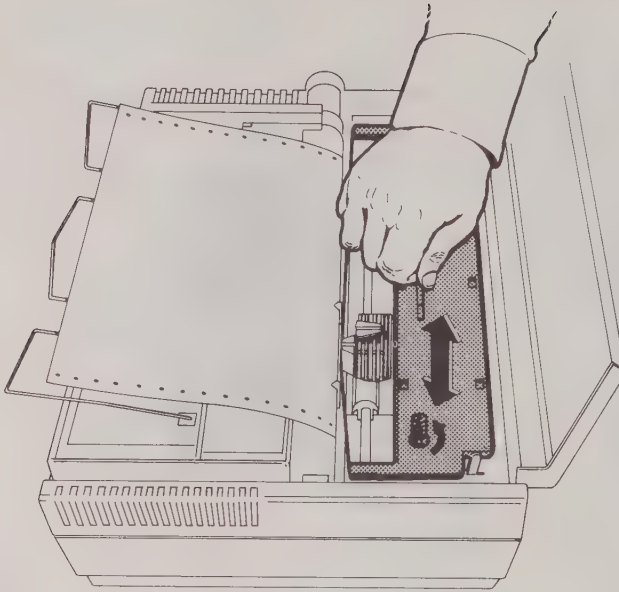


Fig. 5/15 Installation/removal of the ribbon cartridge

- Hold cartridge by the handling rib (Fig. 5/15) and apply light pressure to snap it into place in the two grooves. If the cartridge does not snap into place easily on the left-hand side, turn the thumbwheel (1, Fig. 5/16) in the direction of the arrow until the cartridge can be pressed down.

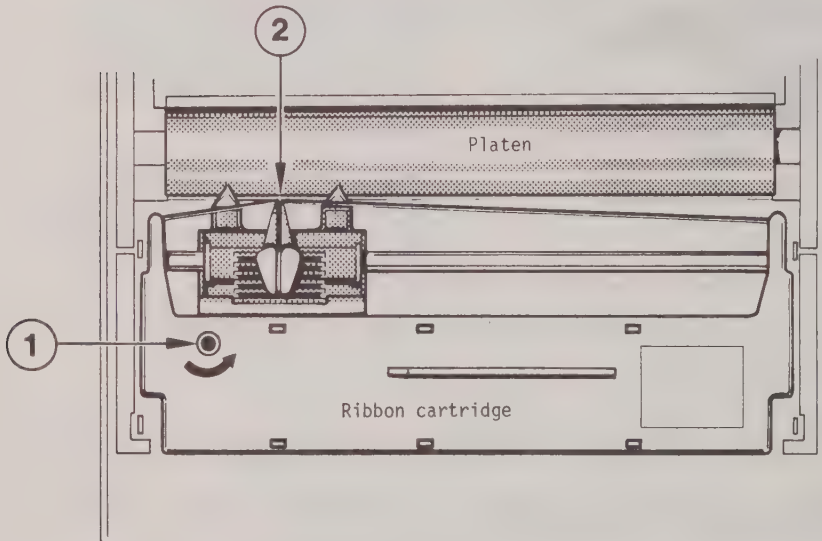


Fig. 5/16 Print head and ribbon cartridge viewed from above

- Push ribbon (2) between needle print head and platen with, for instance, a pencil. Ensure that the ribbon is not located in front of the paper deflectors (see Fig. 5/2).
- The print head should be moved to and fro until slack is removed from the ribbon.

To remove the ribbon cartridge, simply take hold of the handling rib and lift the cartridge vertically up and out.

6 Programming

6.1 General

Full use of the possibilities offered by microcomputer control techniques allows variation of all printing parameters. Such parameters are form length, character and line spacing, line width, character fonts, tabulators, graphics mode etc.

The most frequently required functions are implemented in the standard configuration. Additional functions are available as options with the function expansion module.

The function expansion module makes provision for customized or loadable character generators, block graphics and other graphics printing methods etc.

6.2 Programming information

The print functions to be called up and programmable print parameters differ in their entry and execution instants. To ensure the correct performance of the functions, the following classification must be observed when entering control characters and control character sequences:

- 1) Print functions, which are used as end-of-line criteria, initiate printing. These functions can be placed at any point in the text and are executed immediately after the line has been printed. Deactivation is not necessary (e.g. CR, LF, FF, VT).
- 2) Print functions which can be switched over at any point in the text and are executed immediately with printing (e.g. expanded print, underlining, HT, character generators).
- 3) Parameters and functions which must be programmed after CR and before the following printable character. They directly affect the following printing of text or change the performance of the corresponding print functions, when these are called up (e.g. set HT stops, change line spacing etc.). Several function and parameter entries can be arranged as required in a sequence (e.g. character spacing change, set HT stops etc.).
- 4) Parameters and functions, as under 3), which however may only be programmed in the top-of-form position (e.g. after FF), set VT stops is an example.

The indices in the control character table (section 6.10) show the classification of the functions.

6.3 Initial status

The initial status is automatically reinstated after "Power ON" (and after a power outage). Various characteristics of the initial status can be changed by setting the coding switches on the central control (see section 4.3).

The initial status is as follows:

- Receive buffer reset
- Character spacing 10 cpi
- Horizontal tabulator stops cleared
- Vertical tabulator stops cleared
- Current paper position is interpreted as top-of-form position

in accordance with the coding switch setting on the ZS:

- Character set
- Line spacing 6 or 8 lines/inch
- Form length (11" or 12" $\approx$ 66 or 72 lines with 6 lines/inch)

Resetting to the initial status

By means of the control character sequence

ASCII: ESC c

all parameters listed above are reset to the initial status under program control (section 6.8.1).

The functions defined for the initial status can be reprogrammed using the control character sequences described in the following:

6.4 Print head movement

The print path optimization feature of the printer ensures that the programmed functions are performed as efficiently as possible (minimum time and travel).

6.4.1 Carriage return

ASCII:	CR
HEX. :	0D
DEC. :	13

CR initiates printing of a text line stored in the receive buffer. Following CR, the next text line starts in the first print column at the left-hand margin or in the first print column programmed as the start of the line.

If the function CR = CR + LF is set with the coding switch, an LF is automatically inserted (NEW LINE function) after printing.

Notes:

- If a line only consists of "Spaces", there is no motion of the print head.
- If the maximum line width (80/136 characters with 1/10" character spacing) or the programmed end of the line is exceeded, this is interpreted as a print criterion. At the end of the line, CR/LF is automatically generated and text extending beyond the end of the line is printed on the following line.
- If there is a pause > 1 s on reception of a text line, the line is printed without performance of CR. Following text is printed without leaving a space.

6.4.2 Character spacing

Code	Standard print (10 cpi)	Condensed print 1 (12 cpi)	Condensed print 2 (17 cpi)
ASCII:	ESC [1 w	ESC [2 w	ESC [4 w
HEX.:	1B 5B 31 77	1B 5B 32 77	1B 5B 34 77
DEC.:	Ø27 Ø91 Ø49 119	Ø27 Ø91 Ø5Ø 119	Ø27 Ø91 Ø52 119

In the initial status (e.g. after "Power ON"), standard print with 1/10" character spacing is set. Originating from this initial status, condensed print with 1/12" and 1/17" character spacing can be programmed.

The character spacing must be changed after CR before the next print character. The complete line is then printed with the character spacing selected. Changeover within a line is not possible.

The first print column at the actual start of a line is identical for every character spacing set.

If the sequence for character spacing change is placed in the text and not after CR, this is treated and printed in the same manner as an invalid control character sequence.

6.4.3 Expanded print

Expanded print ON:			
ASCII:	ESC	8	
HEX.:	1B	38	
DEC.:	Ø27	Ø56	

Expanded print OFF:			
ASCII:	ESC	<	
HEX.:	1B	3C	
DEC.:	Ø27	Ø6Ø	

The control character sequence ESC 8 is used to switch from the current character spacing to expanded print. It can be placed anywhere in the text. Text following this sequence is in expanded print.

Expanded print doubles the character width and thus the character spacing (including spaces). Each character column is printed twice. This also applies to inserted single columns.

The control character sequence ESC < is used to switch back from expanded print to the character width as per the original character spacing set. The change can be made character by character at any point on a text line.

Example:

Text structure: AAA ESC8 B ESC < AAA
 Printing: AAAEAAA

Figs. 6/1 and 6/2 show how expanded print is produced. The characters B and d are shown in Fig. 6/1 in standard print and in Fig. 6/2 in expanded print. The two characters are shown underlined.

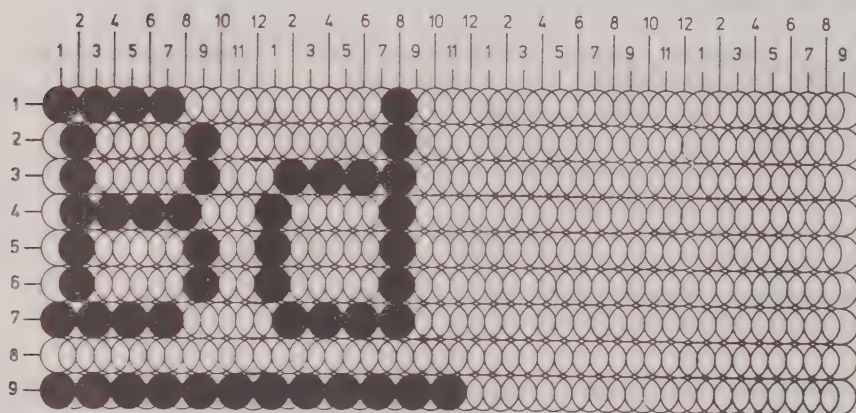


Fig. 6/1 Standard print

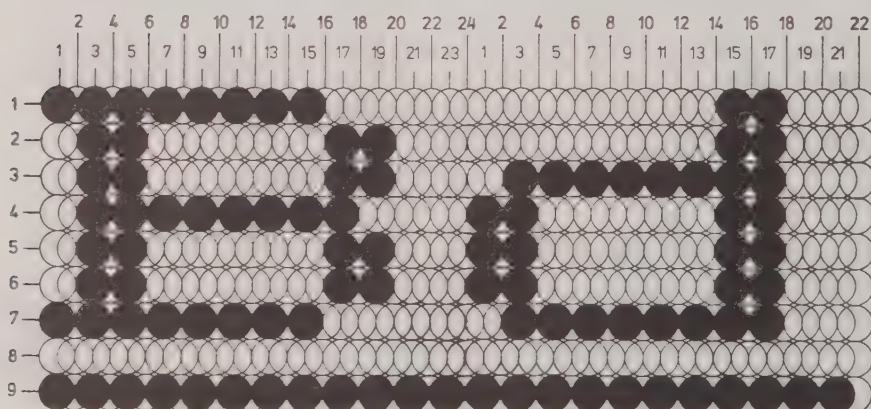


Fig. 6/2 Expanded print

6.4.4 Insertion of filler steps (proportional spacing)

Code	Prop. spacing ON:					Prop. spacing OFF:				
ASCII:	ESC	□	n	Space	E	ESC	□	Space	E	
HEX. :	1B	5B	n	20	45	1B	5B	20	45	
DEC. :	027	091	n	032	069	027	091	032	069	

"n" = number of filler steps to be inserted (1 to 6);
one digit, decimal

One filler step corresponds to the spacing for one print column
(= 1/6 character spacing)

"n" = $\emptyset$ corresponds to "Proportional spacing OFF"

Through the insertion of 1 to 6 filler steps, this function increases the intercharacter space before the following text character (Fig. 6/3). Left-and-right margin justification can thus be achieved.

The function can be activated and deactivated anywhere on a line. Changeover takes effect immediately. Invalid parameter entries ($n > 6$) are treated as an invalid control character sequence. If a character preceded by filler steps causes the line to overflow, both character and filler steps go onto the next line.

Example:

Printing: 1st print position ESC [2 SPE E 80th print pos.
 ↓ ... Filler steps, which ↓ cause the ↓
 line to overflow ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑
 ↑ ↑ ESC [SPE E two filler steps in each case
 2 filler steps

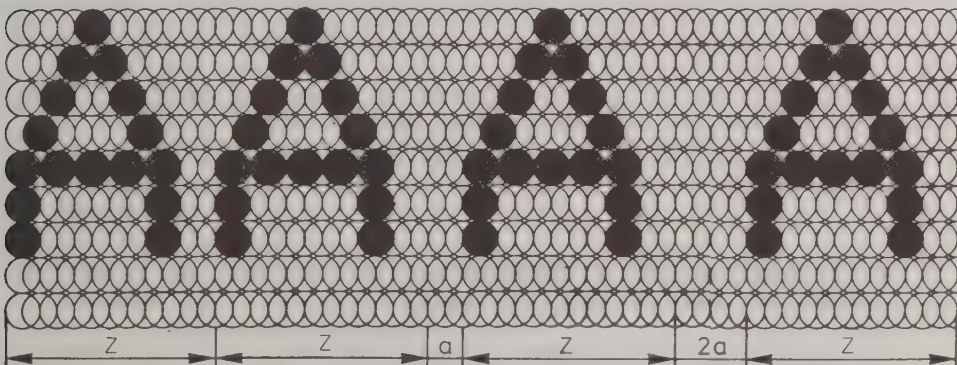
Example:

Text structure: AA ESC [1 Space E A ESC [2 Space E A ESC [Space E

Printing (see also Fig. 6/3):

AAAAA

1 filler step 2 filler steps



$a = 1$ filler step $\hat{=}$ 1 column of character matrix = $1/6$ character

Fig. 6/3 Intercharacter spaces with proportional spacing

6.4.5 Underlining

Underlining ON:			Underlining OFF:		
ASCII:	ESC	Ø	ASCII:	ESC	9
HEX. :	1B	3Ø	HEX. :	1B	39
DEC. :	Ø27	Ø48	DEC. :	Ø27	Ø57

The 9th (lowest) trace of the character matrix is used for underlining. The function is continuous from character to character including spaces, filler steps and horizontal tabs.

The function can be activated and deactivated from character to character. (Text underlining is shown in Fig. 6/1.)

6.4.6 Programming horizontal tabulator stops

ASCII:	ESC	[	p1	;	p2	;	...	;	p12	q
HEX. :	1B	5B	p1	3B	p2	3B	...	3B	p12	71
DEC. :	Ø27	Ø91	p1	Ø59	p2	Ø59	...	Ø59	p12	113

"p1" = position of first HT stop
 "p2" = position of second HT stop etc. to
 "p12" = position of last HT stop
 "p1"..."p12" = ØØ1 to 233, three-digit, decimal;
 leading zeros can be omitted

The horizontal tabulator uses the absolute addressing method, i.e. all tabulator addresses refer to the first print position on a line. The individual tabulator addresses (HT stops) indicate the print positions at which printing is to be continued after a tabulator jump. The absolute position of the HT stops is always based on the current character spacing, i.e. a character spacing change causes the HT stop raster to change as well.

A maximum of 12 tabulator stops can be programmed on a line. The conditions are as follows:

- Programming is implemented at the start of the line after CR before the next print character and takes effect immediately. The first print position has tabulator address 1.
- Tabulator stops must be entered in ascending order. HT stops not entered in ascending order are ignored.
 Correct: 5; 20; 32; 58; 70 Incorrect: 5; 20; 58; 32; 70

32
 |
 is ignored
- Tabulator addresses which exceed the maximum line length or which are outside the programmed line width are ignored.
- If more than 12 HT stops are entered, this is interpreted as a syntax error.

Maximum character number/line:

	PT 88	PT 89
10 cpi	80	136
12 cpi	96	164
17 cpi	136	233

6.4.7 Horizontal tabulator jump

ASCII:	HT
HEX. :	09
DEC. :	009

The control character HT can be placed at any point on a line and initiates a jump to the next tabulator position. If HT is entered several times, tabulator stops can be skipped, i.e. HT HT HT HT initiates a jump to the 4th tabulator stop.

The conditions are as follows:

- At least one tabulator stop must be set.
- If no tabulator stop is set, the HT command is ignored.
This applies correspondingly when the last HT position on a line is reached.
- The HT jumps are handled in ascending order.
- The jump is always made to the next reachable HT position.
Backward jumps are not possible.
- HT jumps do not go beyond the end of the line.

Example:

HT stops are set at positions 8, 12, 18 and 24.

Text structure:

ESC [8; 12; 18; 24 g AAA HT HT BBB HT CCC HT DDD HT EEE

control character
sequence for HT entry

character sequence

Printing: AAA BBB CCC DDDEEE

123456789012345678901234567890
1 2 3

The second HT stop is jumped and the last HT jump is ignored as no HT stop is set.

6.4.8 Clearing and altering horizontal tabulator stops

ASCII:	ESC	[	3	g
HEX. :	1B	5B	33	67
DEC. :	027	091	051	103

All tabulator stops entered are cleared.
Programming is effected at the start of the line.
HT stops can also be cleared by means of the functions:

- Reset parameters
- Reset printer to initial status.

Individual HT stops cannot be cleared, altered or inserted.
To alter a stop, the complete set of tabulator stops must be overwritten.

6.4.9 Programming first and last print position

ASCII:	ESC	␣	p1	;	p2	s
HEX.:	1B	5B	p1	3B	p2	73
DEC.:	Ø27	Ø91	p1	Ø59	p2	115

"p1" = position of first print position at left-hand margin

"p2" = position of last print position at right-hand margin

"p1", "p2" = decimal position data in 1/10" increments
(from 1 to 80/136) in ASCII code

"p1" ≤ "p2"

This function programs the left- and right-hand margins of the print line and the horizontal line format (= printable area) is fixed with respect to width and position on the paper. Programming is performed at the start of the line and takes effect after the next line feed.

The following must be observed:

- The position data are given in 1/10" increments, starting from the first print column.
- It is possible to specify the first parameter "p1" only (ESC p1 s). The current value is retained for "p2".
- Characters which do not fit completely onto the line cause the line to overflow.
- HT stops placed outside the programmed line width are ignored.

Note: If expanded print and filler steps are used, the programmed line width must be at least 4/10" (p2 = p1 + 3). With a lower line width, an expanded print character and/or filler steps cause the line to overflow, without text being printed. The printer moves the paper only and must be switched off.

Example: A text without programmed start and end of line is printed. The line format is then programmed so that 0.4" (= 4/10" increments) is kept free at the left-hand margin and the line width is 3.2" (= 32/10" increments).

Entry in ASCII: CR LF ESC ␣ 5 ; 36 s

Entry in HEX. : ØØ ØA 1B 5B 35 3B 33 36 73

Printing without programmed line format

CR LF

Printing with programmed line format

Printing with PT 88/PT 89

Print example:

Printing without programmed line format

Printing with programmed line fo
rmat

6.4.10 Deletion of first and last print position

ASCII:	ESC	[	s
HEX. :	1B	5B	73
DEC. :	Ø27	Ø91	115

Start and end of line are reset to the maximum line length (corresponding to initial status). Programming is performed at the start of the line and takes effect at the next line feed.

6.5 Paper movement

6.5.1 Line feed

```
ASCII:  LF
HEX.   :  0A
DEC.   :  10
```

LF initiates printing of a text line stored in the receive buffer and paper feed by the currently selected line spacing (initial setting with coding switch = 1/6"). The text in the following line is continued at the next print position.

Example:

Coding switch setting: LF = LF, CR = CR

Text structure: AAAAA LFBBBBB LFCCCC LF12233...000000

```

Printing:      AAAAAA
                BBBBBB
                CCCC
                12233...00
                0000
                79th character
                80th character
                (auto. LF/CR due
                to line overflow)

```

If the function LF = LF + CR is set with the coding switch or if a CR follows an LF, the next line is begun at the start of the line. The smallest line spacing that can be programmed is 1/72".

Example:

Coding switch setting: LF = LF + CR, CR = CR + LF

Text structure: AAAAAA LFBBBBB CR LF CCC...

```
Printing:      AAAAAAA
               FFFBBB
               000 ...
```

6.5.2 Form feed

```

ASCII:  FF
HEX.   :  0D
DEC.   :  13

```

- FF terminating a received text line causes the text to be printed out followed by paper feed to the next top-of-form position. The current print position is retained. No CR is performed.

- After a form feed tripped by FF, a subsequent FF control character only causes a new form feed if beforehand at least one printable character (including space) or one paper feed character (LF, VT, ESC K, ESC L) or CR (coding switch setting CR = CR + LF) or parity error was received.
- See section 6.5.9 for further functions.

6.5.3 1/2 line feed forward/backward

Forward:	Backward:
ASCII: ESC K	ASCII: ESC L
HEX. : 1B 4B	HEX. : 1B 4C
DEC. : 027 075	DEC. : 027 076

These two control character sequences initiate paper transport by 1/12" (corresponds to 1/2 line referred to 1/6" line spacing) in the forward or backward direction. They can be placed at any point in the text and are particularly useful for printing mathematical formulas with exponents and indices. The function is independent of the line spacing set at that time.

The 1/2 line feed backward may only be performed up to 1/12" before the top edge of the form, to avoid paper movement disturbances.

Example:

Entry in ASCII:

A ESC L 2 ESC K + B ESC L 2 ESC K = C ESC L 2 ESC K

Printing: $A^2 + B^2 = C^2$

Observe special condition for the first and last programmed line.

6.5.4 Programming line spacing

ASCII: ESC	[	n	x
HEX. : 1B	5B	n	78
DEC. : 027	091	n	120

"n" = 0 to 99 in 1/72" units as one- or two-digit decimal number in the ASCII code

This control character sequence can be used to program the line spacing in multiples of 1/72". The maximum line spacing possible (n = 99) is 99/72" = 1 3/8".

The function must be programmed after CR and before the first printable character. The next line feed is performed with the spacing programmed. The line spacing can be reset to the line spacing defined by the initial status (6 or 8 lpi) by:

- Reprogramming the spacing parameter after CR
- Control character sequence "Reset printer to initial status"
- Control character sequence "Reset parameters".

Example:

Entry in ASCII:

```
Printer PT 88 CR/LF
ESC [ 48 x           ≐ line spacing 4/6" (48/72")
the compact version CR/LF
ESC [ 12 x           ≐ line spacing 1/6" (12/72")
Printer PT 89 CR/LF
the wide version
```

Printing: Printer PT88
the compact version

Printer PT89
the wide version

6.5.5 Programming form length

ASCII:	ESC	[	n	p
HEX. :	1B	5B	n	70
DEC. :	027	091	n	112

"n" = 0 to 99 in 1/6" units, one- or two-digit decimal number in the ASCII code

The form length is defined as a physical length in the initial status. Depending on the coding switch setting, it is 11" (66 lines with 1/6" line spacing) or 12" (72 lines with 1/6" line spacing). See also section 4.3.

To allow the printer to handle other form sizes, the form length can be programmed in n-fold 1/6" units. The form length must be programmed after CR before the first printable character and takes effect immediately. Subsequent line spacing changes have no effect on the form length.

By programming the form length:

- the current print line becomes the new top-of-form position
- a programmed first line and last line are deleted
- n = 0 causes all form-specific functions (FF, VT, 1st and last line) to be deactivated.

The programmable form length is obtained by multiplying n by 1/6".

Example:

```
Required form length = 3"
1/6" units           = 3 x 6/6" = 18/6"
```

```
Programming in ASCII: ESC [ 18 p
Programming in HEX. : 1B 5B 31 38 70
```

Entries 99 or without line number are treated as syntax errors.
The form length is altered by re-programming.

6.5.6 Programming vertical tabulator stops

ASCII:	ESC	[	p1	;	p2	;	...	;	p12	r
HEX.:	1B	5B	p1	3B	p2	3B	...	3B	p12	72
DEC.:	Ø27	Ø91	p1	Ø59	p2	Ø59	...	Ø59	p12	114

"p1" = position of first VT stop

"p2" = position of second VT stop etc. to

"p12" = position of last VT stop

"p1"..."p12" = one- to two-digit decimal number in ASCII code

The vertical tabulator uses the absolute addressing method, i.e. the VT stops determine stop positions within the form which can be jumped to by entering the VT command. The address of a VT stop is specified as a line number "p" referred to the top-of-form position.

Programming the tabulator stops is based on the line spacing valid at that time. Subsequent changes to the line spacing have no effect on the absolute position of the VT stops.

The conditions are as follows:

- Programming is performed at the top-of-form position.
- A maximum of 12 VT stops can be programmed in ascending order.
- VT addresses are counted starting with 1 in the first print line of the form (top-of-form position).
- The entry of more than 12 VT stops and VT addresses > 99 are treated as syntax errors.

6.5.7 Vertical tabulator jump

ASCII:	VT
HEX.:	ØB
DEC.:	Ø11

Recognition of the control character VT initiates a line jump to the next VT stop programmed. VT can be entered at any point on a print line and acts as an end-of-line criterion. If several VT control characters are entered, tabulator stops can be skipped, i.e. VT VT VT VT initiates a jump to the 4th VT stop.

The conditions are as follows:

- VT does not cause CR, i.e. the actual print position is retained.
- At least one VT stop must be set. If no VT stop is set, the VT command is ignored.
- The VT stops are handled in ascending order.
- VT jumps do not exceed the length of the form.
- VT stops which are not entered in ascending order or are outside the programmed form length or are after the last programmed line are ignored.

Example:

VT stops must be set in lines 5, 10, 15, 20 and 25.

Programming of the VT stops in the ASCII code:

ESC [5 ; 10 ; 20 ; 15 ; 25 r
*)

Input text in ASCII:

Vertic. tab test VT position 5 CR VT position 10 VT position 15
VT position 20 VT position 25 CR LF End

Printing:

1st line	Vertic. tab test
5th line	position 5
10th line	position 10
15th line	
20th line	position 15
25th line	position 20 position 25
	end

*) No jump is made to the 15th line as the stop position was not entered in ascending order. As no further VT stop is set after the 25th line, the 5th VT command is ignored.

6.5.8 Clearing and altering vertical tabulator stops

ASCII:	ESC	[	4	g
HEX.:	1B	5B	34	67
DEC.:	Ø27	Ø97	Ø52	1Ø3

All tabulator stops entered are cleared. Individual stops cannot be cleared, altered or inserted. The complete tabulator stop set must be overwritten or cleared.

6.5.9 Programming first and last print line

ASCII:	ESC	[	p1	;	p2	{
HEX.:	1B	5B	"p1"	3B	"p2"	7B
DEC.:	Ø27	Ø91	"p1"	Ø59	"p2"	123

"p1" = position of first printable line in 1/6" increments *)

"p2" = position of last printable line in 1/6" increments *)

*) Within the form length referred to top-of-form position

"p1", "p2" = decimal number from 1 to 99 in the ASCII code

"p1" ≤ "p2"

The programmed first and last lines define a printable area within the form. Printing is inhibited outside this area. After the last printable line has been reached, feed takes place automatically to the first programmed line of the next form (= skip over perforation function).

The programming conditions are as follows:

- Programming is performed anywhere within the form after CR before the following print character and takes effect at the next FF.
- The form length must be programmed before the function "first and last line".
- It is possible to specify only the first parameter "p1" (ESC [p1 {). The current value is retained for "p2".
- The maximum area is limited by the actual form length (FL).
p1 or p2 > FL → is treated as a syntax error.
- Control character FF causes a jump to the 1st programmed line of the next form and not to the top-of-form position. The function of the FF pushbutton is not altered.
- LF or line overflow in the programmed last line causes an automatic jump to the programmed 1st line of the next form (= skip over perforation).
- In the programmed first line, half-line backward feed to write exponents is possible. No backward movement exceeding 1/12" is performed.
- In the programmed last line, half-line feed to write indices is possible. With feed exceeding 1/12", a jump is made to the first line of the following form.

Example:

The printable area (height and width) is defined for printing.

Form length: 6"

Form width: 8"

Line width: 6" with 1" margins

1st printable line: 1" from the top edge of the form

last printable line: 1" from the lower edge of the sheet

Entry in ASCII:

ESC [36 p set form length

ESC [11 ; 70 s set start and end of line

ESC [6 ; 30 { set first and last line

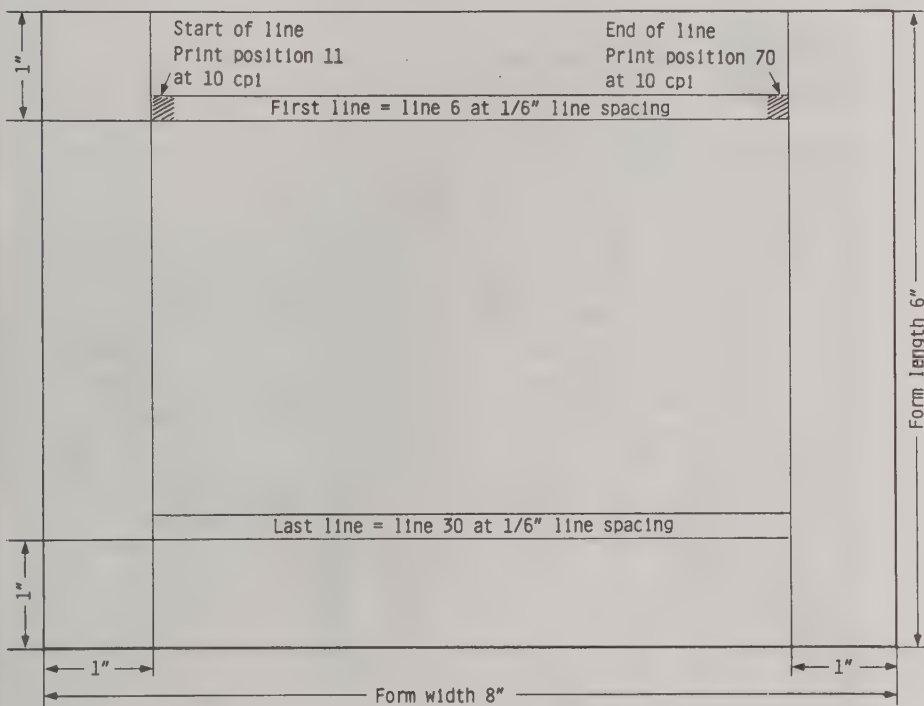


Fig. 6/4 Example of a printable area

6.5.10 Deletion of first and last printable line

ASCII:	ESC	[	{
HEX. :	1B	5B	7B
DEC. :	027	091	123

- The format used for printing is reset to the actual form length and the "skip over perforation" function is deactivated.
- Programming is performed after CR and takes effect at the next FF.
- The same function is also tripped when the form length is altered.

6.6 Character generator

The Printer PT 88/PT 89 is equipped with a preset character generator offering the standard character set of the International Alphabet No. 5 (IA No. 5) and seven national character sets, including the ASCII character set.

The character sets can be called up by means of control characters. The character set for the initial status is selected with coding switches (see section 4.3). The following tables show the basic character set common to all configurations (Fig. 6/5) and the special characters that vary in the 8 character sets (Fig. 6/6).

Row Zeile	Column Spalte											
	b7	0	0	0	0	1	1	1	1			
	b6	0	0	1	1	0	0	1	1			
b4	b3	b2	b1	HEX.	0	1	2	3	4	5	6	7
	0	0	0	0	0	NUL	DLE	SP	0	P	p	
0	0	0	1	1	1	SOH	DC1	!	1	A	Q	a
0	0	1	0	2	2	STX	DC2	"	2	B	R	b
0	0	1	1	3	3	ETX	DC3		3	C	S	c
0	1	0	0	4	4	EOT	DC4		4	D	T	d
0	1	0	1	5	5	ENQ	NAK	%	5	E	U	e
0	1	1	0	6	6	ACK	SYN	&	6	F	V	f
0	1	1	1	7	7	BEL	ETB	'	7	G	W	w
1	0	0	0	8	8	BS	CAN	(	8	H	X	h
1	0	0	1	9	9	HT	EM	)	9	I	Y	i
1	0	1	0	A	10	LF	SUB	*	:	J	Z	j
1	0	1	1	B	11	VT	ESC	+	;	K		k
1	1	0	0	C	12	FF	FS	,	<	L		l
1	1	0	1	D	13	CR	GS	-	=	M		m
1	1	1	0	E	14	SO	RS	.	>	N		n
1	1	1	1	F	15	SI	US	/	?	O	_	o
											DEL	

IA No. 5		Hex.-Code	ASCII	Schwedisch, Finnisch, Schwedisch, Finnisch	Dänisch, Norwegisch, Dänisch, Norwegisch	Deutsch, German	Britisch, British	Spanisch, Spanish	Französisch, Belgisch, French, Belgian	International
Spalte Column	Zeile Row									
2	3	23	#	s	#	#	£	#	£	#
2	4	24	\$	¤	¤	\$	\$	\$	\$	¤
4	0	40	@	É	É	£	@	@	à	@
5	11	5B	[	Ä	Æ	Ä	[	i	°	[
5	12	5C	\	Ö	Ø	Ö	\	ñ	ç	\
5	13	5D	]	Å	Å	Ü	]	ú	§	]
5	14	5E	^	^	Ü	^	^	^	^	^
6	0	60	`	é	é	`	`	`	`	`
7	11	7B	{	ä	æ	ä	{	'	é	{
7	12	7C		ö	ø	ö		ñ	ú	
7	13	7D	}	å	ä	ü	}	ç	è	}
7	14	7E	~	ü	ü	ß	-	"	"	-

Fig. 6/5 Standard code table

Fig. 6/6 Special characters

The shaded boxes mark code positions assigned national characters with the coding switch or via control characters. Columns and rows are in hexadecimal and decimal notation. The diagonal lines in columns 0 and 1 mark control characters which are not used by the Printer PT 88/PT 89.

The following table shows the control characters required to call up the various character sets. A different character set can be called up at any point on a line.

Character set	Code	Control character sequence
International	ASCII HEX. DEC.	ESC (@ 1B 28 40 027 040 064
English	ASCII HEX. DEC.	ESC (A 1B 28 40 027 040 065
ASCII	ASCII HEX. DEC.	ESC (B 1B 28 42 027 040 066
Danish/ Norwegian	ASCII HEX. DEC.	ESC (E 1B 28 45 027 040 069
Swedish/ Finnish	ASCII HEX. DEC.	ESC (H 1B 28 48 027 040 072
German	ASCII HEX. DEC.	ESC (K 1B 28 4B 027 040 075
French/ Belgian	ASCII HEX. DEC.	ESC (R 1B 28 52 027 040 082
Spanish	ASCII HEX. DEC.	ESC (3 1B 28 33 027 040 051

6.7 Graphics printing

6.7.1 General

Individual selection of the nozzles, or needles, allows the Printer PT 88/PT 89 to print graphics using the bit-image printing method. Text is printed in one direction from left to right, the parity check is deactivated and the 8th bit is interpreted as a data bit. Only 8 of the 9 needles, or nozzles, are used.

Selection of 8/72" line feed permits continuous black printing of the print area.

The format parameters programmed for character printing are also valid for graphics printing. These are as follows:

- Form length - Start and end of line
- Line spacing - First and last line
- Character spacing

Via the character spacing, the horizontal dot density can be selected. Reprogramming of character spacing and line spacing or other parameters must always be implemented before switching to graphics printing.

Bit-image printing is possible with all character spacings. The following dot densities can be obtained:

Character spacing	Dot density	Print density
10 cpi	60 dpi *)	480 columns/line
12 cpi	72 dpi **)	576 columns/line
17 cpi	102 dpi	816 columns/line

The number of print columns is the maximum possible on 250 mm paper.

*) dpi = dots per inch

**) It is possible to generate a square matrix with 1/72" dot spacing.

In addition to the standard bit-image printing, the PT 88/PT 89 offers further graphics methods as options (see section 6.9).

6.7.2 Programming

Bit-image printing is activated with the control character sequence

ASCII:	ESC	[	n	y
HEX. :	1B	5B	n	79
DEC. :	Ø27	Ø91	n	121

"n" = number of bit-image columns

"n" = one- to four-digit decimal number in the ASCII code

The conditions are as follows:

- The bit-image function can be activated at any point within a line.
- The number of columns defines the length of the bit-image data block.
- After activation of this function, the following n data characters are printed as column information.
- The dot density cannot be changed in the bit-image mode. The dot density effective before activation of the function is valid.
- No control characters are recognized in the bit-image data stream.
- When the end of the line is reached, a line feed is automatically performed with the programmed line spacing. Bit-image printing is continued on the next line.

Bit-image printing is automatically deactivated when the programmed n bit-image data have been printed or in response to "Power OFF".

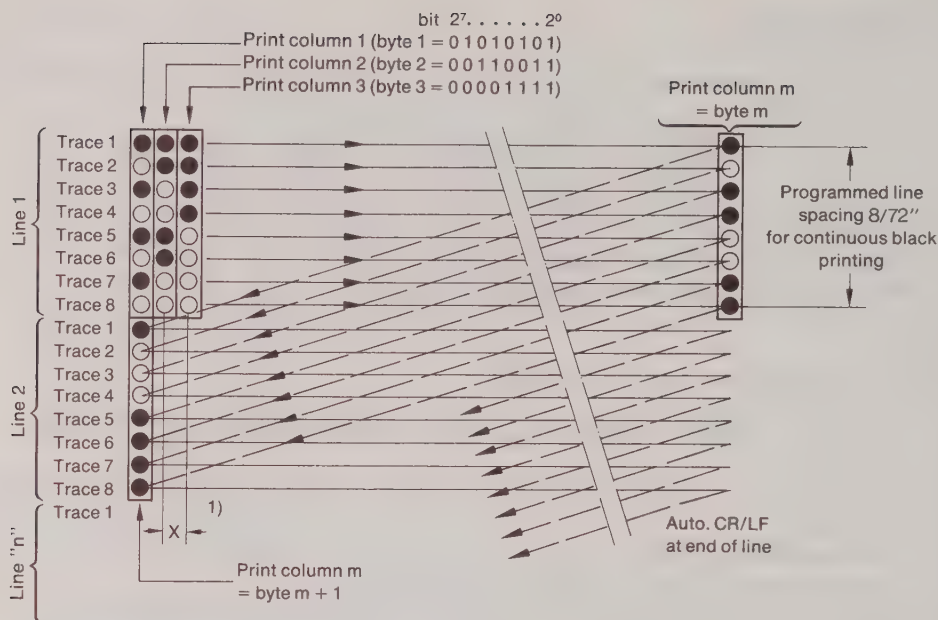
6.7.3 Trace assignment and printing principle

The upper 8 nozzles, or needles, of the print head are selected individually via the interface. Each byte transmitted therefore corresponds to a complete 8-dot print column in bit-image printing. The 9th trace is not used (Figs. 6/7, 6/8).

Print head

Needle/nozzle 1	●	Trace 1	Data bit 1 Printing (2^0)	LSB
Needle/nozzle 2	●	Trace 2	Data bit 2 Printing (2^1)	
Needle/nozzle 3	●	Trace 3	Data bit 3 Printing (2^2)	
Needle/nozzle 4	●	Trace 4	Data bit 4 Printing (2^3)	
Needle/nozzle 5	●	Trace 5	Data bit 5 Printing (2^4)	
Needle/nozzle 6	●	Trace 6	Data bit 6 Printing (2^5)	
Needle/nozzle 7	●	Trace 7	Data bit 7 Printing (2^6)	
Needle/nozzle 8	●	Trace 8	Data bit 8 Printing (2^7)	MSB
Needle/nozzle 9	●	Trace 9	not used	

Fig. 6/7 Trace/data bit assignment



- 1) The spacing "x" (bit-image dot spacing) is dependent on the character spacing selected (see table in section 6.7.1).

Fig. 6/8 Bit-image printing principle

Examples of graphics printing (programmed in BASIC)

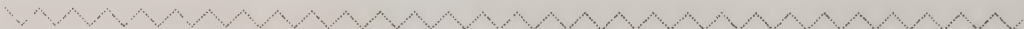
Example 1

in lines 60 and 100: [Δ exponential function

```

10                                :REM "graphics printing wavy line"
20 LPRINT CHR$(27) "E2w";       :REM "switchover to 12 cpi"
30 LPRINT CHR$(27) "I0420y";    :REM "graphics ON, 420 characters"
40 FOR A=1 TO 30                :REM "print 30 waves"
50 FOR B=0 TO 6                 :REM "falling edge"
60 C=2CB
70 LPRINT CHR$(C);
80 NEXT B
90 FOR B=7 TO 1 STEP -1         :REM "rising edge"
100 C=2CB
110 LPRINT CHR$(C);
120 NEXT B
130 NEXT A
140 END

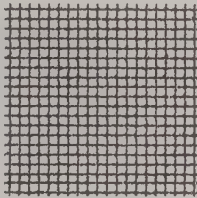
```



Example 2

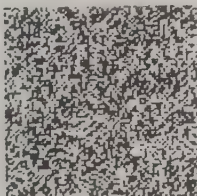
```
200                                     :REM "multi-line graphics printing"
205 LPRINT CHR$(27) "[2w"           :REM "switchover to 12 cpi"
210 LPRINT CHR$(27) "[08x";         :REM "switchover of line spacing
                                     to 8/72"
220 FOR A=1 TO 10
230 LPRINT CHR$(27) "[0080y";:REM "graphics ON, 80 characters"

240 FOR B=1 TO 20
250 LPRINT CHR$(34) CHR$(255) CHR$(34) CHR$(34);
260 NEXT B
270 LPRINT ""                       :REM "line feed"
280 NEXT A
290 LPRINT CHR$(27) "[12x";         :REM "return to 6 lpi"
300 END
```



Example 3

```
500                                     :REM "random number graphics"
505 LPRINT CHR$(27) "[2w";          :REM "switchover to 12 cpi"
510 LPRINT CHR$(27) "[08x";         :REM "line feed 8/72"
520 FOR A=1 TO 10
530 LPRINT CHR$(27) "[0080y";:REM "graphics ON, 80 characters"
540 FOR B=1 TO 80
550 C=RND(240)+15                   :REM "random number without
                                     characters of column 0"
560 LPRINT CHR$(C)
570 NEXT B
580 LPRINT ""                       :REM "line feed"
590 NEXT A
600 LPRINT CHR$(27) "[12x";         :REM "return to 6 lpi"
610 END
```



6.7.4 Switchover between character printing and bit-image printing

- Within a line only one dot density is possible for bit-image printing and text characters, depending on the character spacing selected.
- Within a line switching between text characters and bit-image data is possible as often as required.
- After reception of the last text character, the next possible bit-image column is printed in the first print column of the following print position.
- After reception of the last bit-image information, the following text character is printed without a space, irrespective of the matrix as determined by the character spacing (Fig. 6/9).
- Entered text parameters such as "expanded print", "underlining" and "filler steps" have no effect in bit-image printing, they however function again after switching over to character printing.

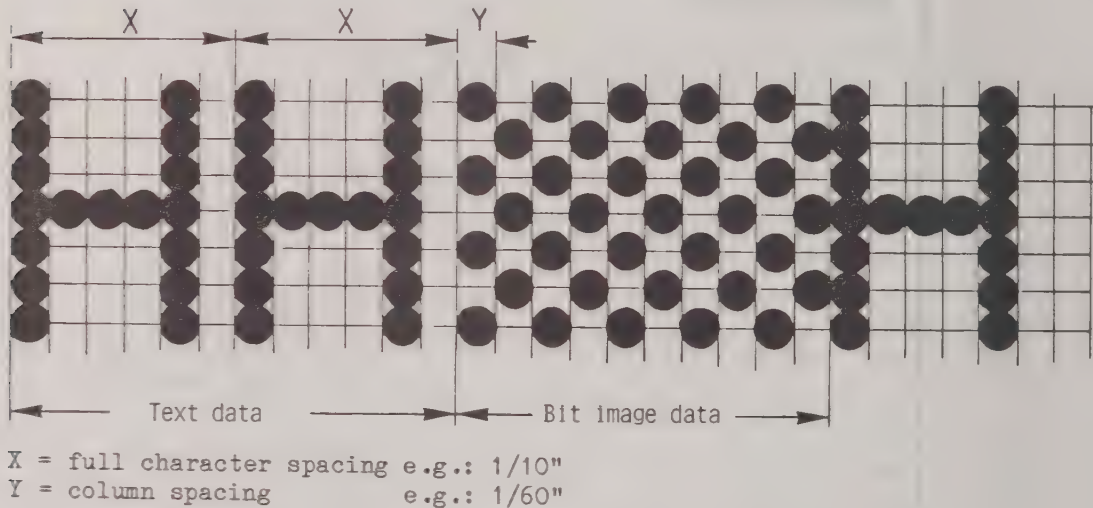


Fig. 6/9 Switchover between character printing and bit-image printing

6.8 General functions

6.8.1 Reset printer to initial status

ASCII:	ESC	c
HEX. :	1B	63
DEC. :	Ø27	Ø99

This command can be placed at any point in the text and acts as an end-of-line criterion. The text line terminated with ESC c is deleted in the receive buffer. The control is reset to the initial status, all programmed parameters are deleted and the paper is transported to the top-of-form position (see section 6.3).

6.8.2 Reset parameters

ASCII:	ESC	R
HEX. :	1B	52
DEC. :	Ø27	Ø82

This command is only effective at the start of a line after CR before the following print characters. It is treated anywhere else as a syntax error. It causes all previously programmed parameters to be reset and the functions as set by the coding switch, when power is applied, to be recognized. Information in the receive buffer is not deleted.

6.8.3 Bell

ASCII:	BEL
HEX. :	Ø7
DEC. :	ØØ7

On reception of the control character BEL, an audible alarm sounds for 1 s, when the control character was recognized during line preparation. Printing is continued after the alarm. If several BEL control characters arrive in succession, the audible alarm is repeated a corresponding number of times. BEL may be placed at any point in the text.

6.9 Optional functions

A separate description is available for each optional function (exception: memory expansion - see section 6.9.1), which can be inserted in the slot on the last sheet. The corresponding function expansion module must be inserted if the PT 88/PT 89 is to be equipped with an option.

The following optional functions are available:

- o Unidirectional printing
- o 2nd character generator (customized)
- o Loadable character generator
- o Other graphics methods
 - 7-bit graphics
 - Scanner graphics
 - Block graphics
- o Control characters as per EPSON

6.9.1 Memory expansion (SPE)

The receive buffer can be expanded to 4 Kbytes by inserting the SPE. If a program component is inserted in the EPROM socket on the SPE, the capacity of the receive buffer is reduced.

Storage capacity of receive buffer:

printer without SPE: 185 characters

printer with SPE: 185 + 4096 = 4281 characters

6.10 List of control characters

6.10.1 Call-up of print functions

The call-up of print functions, the programming of print parameters and communication with the transmitting station takes place with the aid of control characters.

In order to activate the various PT 88/PT 89 functions, the following types of control characters are defined, in addition to the single control characters such as LF, FF etc.

Two-byte sequences for the direct control of equipment functions:

Example: ESC 8

Control character sequence for activating expanded print.

Multi-character control character sequence for changing parameters or programming functions:

Example 1: ESC [p1; p2; pn g

Control character sequence for setting horizontal tabulator stops

ESC = code expansion character
[= identifies multi-character sequence
p = parameter
; = parameter separator
g = function

Example 2: ESC (@

Control character sequence for activating the "International" character set

ESC = code expansion character
(= identifies three-character sequence
@ = function

6.10.2 Syntax errors

Syntax errors in control character sequences or the entry of control characters at invalid positions cause the control character sequence to be printed out. ESC is printed as a large smudge character ().

Example 1: Reception: TEXT1 ESC Z 3 g TEXT2
Correct control character
sequence would be: ESC [3 g
Printing: TEXT1 ⌘ Z 3 g TEXT2

Example 2: Reception: TEXT1 ESC [3 g TEXT2
Printing: TEXT1 ⌘ ⌘ 3 g TEXT2

└──────────┐ Parity error

The following table lists the control characters and their functions defined for the PT 88/PT 89.

Control character function		Control character sequences										Remarks
Carriage return	1)	ASCII	CR									After setting coding switch (section 4.3)
		HEX.	0D									
		DEC.	013									
Character spacing 1/10"	3)	ASCII	ESC	[	1	w						
		HEX.	1B	5B	31	77						
		DEC.	027	091	049	119						
Character spacing 1/12"	3)	ASCII	ESC	[	2	w						
		HEX.	1B	5B	32	77						
		DEC.	027	091	050	119						
Character spacing 1/17"	3)	ASCII	ESC	[	4	w						
		HEX.	1B	5B	34	77						
		DEC.	027	091	052	119						
Expanded print ON	2)	ASCII	ESC	8								Section 6.4.3
		HEX.	1B	38								
		DEC.	027	056								
Expanded print OFF	2)	ASCII	ESC	<								
		HEX.	1B	3C								
		DEC.	027	060								
Filler steps insertion ON (proportional spacing ON)	2)	ASCII	ESC	[	n	SP	E					Section 6.4.4 n = 1 to 6
		HEX.	1B	5B	n	20	45					
		DEC.	027	091	n	032	069					
Filler steps OFF (proportional spacing OFF)	2)	ASCII	ESC	SP	E							
		HEX.	1B	20	45							
		DEC.	027	032	069							
Underlining ON	2)	ASCII	ESC	ø								Section 6.4.5
		HEX.	1B	30								
		DEC.	027	048								
Underlining OFF	2)	ASCII	ESC	9								
		HEX.	1B	39								
		DEC.	027	057								
Program up to 12 horizontal tabulator stops in character spacing selected	3)	ASCII	ESC	[	p1	;	...	;	p12	q		p = 1- to 3-digit decimal as per paper format
		HEX.	1B	5B	p1	3B	...	3B	p12	71		
		DEC.	027	091	p1	059	...	059	p12	113		
Initiate tabulator jump	2)	ASCII	HT									Only if stops are set Section 6.4.6
		HEX.	09									
		DEC.	009									
Reset horizontal tabulator (clear tabulator stops)	3)	ASCII	ESC	[	3	g						
		HEX.	1B	5B	33	67						
		DEC.	027	091	051	103						
Program start and end of line (1/10" units)	3)	ASCII	ESC	[	p1	;	p2	s				p = 1- to 3-digit decimal as per paper format
		HEX.	1B	5B	p1	3B	p2	73				
		DEC.	027	091	p1	059	p2	115				
Delete start and end of line	3)	ASCII	ESC	[	s							
		HEX.	1B	5B	73							
		DEC.	027	091	115							
Line feed	1)	ASCII	LF									After setting coding switch Section 4.3
		HEX.	0A									
		DEC.	010									
Form feed	1)	ASCII	FF									
		HEX.	0C									
		DEC.	012									

See section 6.2 for 1) 2) 3) 4)

Control character function		Control character sequences						Remarks
1/2 line forward	1)	ASCII HEX. DEC.	ESC 1B Ø27	K 4B Ø75				Section 6.5.3
1/2 line backward	1)	ASCII HEX. DEC.	ESC 1B Ø27	L 4C Ø76				
Program line spacing in 1/72" units	3)	ASCII HEX. DEC.	ESC 1B Ø27	␣ 5B Ø91	n n n	x 78 12Ø		Section 6.5.4 n = 1- to 2-digit decimal
Program form length in single-line units (1/6")	4)	ASCII HEX. DEC.	ESC 1B Ø27	␣ 5B Ø91	n n n	p 7Ø 112		Section 6.5.5 n = 1- to 2-digit decimal
Program up to 12 vertical tabulator stops in single- line units	4)	ASCII HEX. DEC.	ESC 1B Ø27	␣ 5B Ø91	p1 p1 p1	; ... ; 3B ... Ø59 p12 72 114	r	p = 1 bis 99 p = 1- to 2-digit decimal
Initiate tabulator jump	1)	ASCII HEX. DEC.	VT ØB Ø11					Only if tabulator stops are programmed
Reset vertical tabulator (clear tabulator stops)	4)	ASCII HEX. DEC.	ESC 1B Ø27	␣ 5B Ø91	4 34 Ø52	g 67 103		
Program first and last print line in 1/6" units	4)	ASCII HEX. DEC.	ESC 1B Ø27	␣ 5B Ø91	p1 p1 p1	; p2 { 3B p2 7B Ø59 p2 123		p = 1- to 2-digit decimal Section 6.5.9
Delete first and last print line	3)	ASCII HEX. DEC.	ESC 1B Ø27	␣ 5B Ø91	{ 7B 123			Section 6.5.10
Preset character generator: International configuration	2)	ASCII HEX. DEC.	ESC 1B Ø27	(28 Ø4Ø	Ⓞ 40 Ø64			Section 6.6
English configuration	2)	ASCII HEX. DEC.	ESC 1B Ø27	(28 Ø4Ø	A 41 Ø65			
ASCII configuration	2)	ASCII HEX. DEC.	ESC 1B Ø27	(28 Ø4Ø	B 42 Ø66			
Danish/Norwegian configuration	2)	ASCII HEX. DEC.	ESC 1B Ø27	(28 Ø4Ø	E 45 Ø69			
Swedish/Finnish configuration	2)	ASCII HEX. DEC.	ESC 1B Ø27	(28 Ø4Ø	H 48 Ø72			
German configuration	2)	ASCII HEX. DEC.	ESC 1B Ø27	(28 Ø4Ø	K 4B Ø75			
French/Belgian configuration	2)	ASCII HEX. DEC.	ESC 1B Ø27	(28 Ø4Ø	R 52 Ø82			
Spanish configuration	2)	ASCII HEX. DEC.	ESC 1B Ø27	(28 Ø4Ø	3 33 Ø51			

See section 6.2 for 1) 2) 3) 4)

Control character function		Control character sequences						Remarks
Activate bit-image printing and program length of bit image block	2)	ASCII	ESC	C	n	y		Section 6.7 n = 1- to 4-digit decimal
		HEX.	1B	5B	n	79		
		DEC.	027	091	n	121		
Reset printer to initial status	1)	ASCII	ESC	c				Section 6.8.1
		HEX.	1B	63				
		DEC.	027	099				
Reset parameters	3)	ASCII	ESC	R				Section 6.8.2
		HEX.	1B	63				
		DEC.	027	099				
Bell	2)	ASCII	BEL					Section 6.8.3
		HEX.	07					
		DEC.	007					
X-ON (printer ready to receive) transmitted by PT 88/PT 89		ASCII	DC1					For serial interface see section 7.1.4.2 and 7.2.4.2
		HEX.	11					
		DEC.	017					
X-OFF (printer not ready to receive) transmitted by PT 88/PT 89		ASCII	DC3					
		HEX.	13					
		DEC.	019					
End of text block		ASCII	ETX					
		HEX.	03					
		DEC.	003					
Text block terminated with ETX was printed (transmitted by PT 88/PT 89)		ASCII	ACK					
		HEX.	06					
		DEC.	006					
Switchover to loadable character generator		ASCII	ESC	5				Only with SFE module plus program module *)
		HEX.	1B	35				
		DEC.	027	053				
Load loadable character		ASCII	ESC	C	t			Only with SFE module plus program module *)
		HEX.	1B	5B	74			
		DEC.	027	091	116			
Character generator 2 customized configuration		ASCII	ESC	(	1			Plus program module *) ZEG 2 (e.g. high caps)
		HEX.	1B	28	31			
		DEC.	027	040	049			
Scanner method ON		ASCII	ESC	C	l			*)
		HEX.	1B	5B	7C			
		DEC.	027	091	124			
Bit-image printing similar to "Epson mx82"		ASCII	ESC	C	y			*)
		HEX.	1B	5B	79			
		DEC.	027	091	121			
Bit-image printing as per Tandy ON		ASCII	ESC	C	y			*)
		HEX.	1B	5B	79			
		DEC.	027	091	121			
Scanner method and bit-image printing OFF (graphic printing OFF)		ASCII	ESC	C	-			*)
		HEX.	1B	5B	7E			
		DEC.	027	091	126			
Control characters not used:		ASCII	HEX.	DEC.	ASCII	HEX.	DEC.	The Printer PT 88/PT 89 does not respond to these control characters
		NUL	00	000	NAK	15	021	
		SOH	01	001	SYN	16	022	
		STX	02	002	ETB	17	023	
		EOT	04	004	CAN	18	024	
		ENQ	05	005	EM	19	025	
		BS	08	008	SUB	1A	026	
		SO	1E	014	FS	1C	028	
		SI	0F	015	GS	1D	029	
		DLE	10	016	RS	1E	030	
		DC 2	12	018	US	1F	031	
		DC 4	14	020				

*) Option

See section 6.2 for 1) 2) 3) 4)

6.11 Parity check

In the character printing mode of the Printer PT 88/PT 89, the parity of the received data can be checked or not checked. In operation with parity check, even or odd parity can be selected. The coding switch on the central control is used to select the mode (see section 4.3 "Coding switch settings"). A parity check in graphics printing using the bit-image method is not possible as the 8th bit is interpreted as a data bit.

Operation without parity check

In this operating mode, the parity of the received data and control characters is not checked.

Operation with parity check

In this operating mode, the parity of the received data and control characters is checked. Even or odd parity can be selected (section 4.3). On switching to bit-image data, the parity check is automatically deactivated.

A smudge character μ is printed on recognition of control characters and printable characters with incorrect parity.

7 P r i n t e r i n t e r f a c e s

The Printer PT 88/PT 89 can be equipped for connection to transmitting stations as required with the following interface adapters (SAP):

- SAP-S1 bit-serial interface as per
CCITT V.24/V.28
EIA Standard RS-232-C
- SAP-S2 bit-serial TTY interface (20 mA current loop)
- SAP-P1 bit-parallel Centronics® interface

The connectors are located on the relevant interface adapter board and are accessible through a cut-out at the rear of the printer. The interface adapters, which are of the plug-in type, are arranged beneath the cover lid, permitting easy conversion of the printer.

When data are transferred bit-serially, the elements of a character are transmitted in turn over a transmission line. The start-stop method is used for character transmission, i.e. each 7-bit combination begins with a start element and is terminated with one or more stop elements. The following figure shows the sequence in which the elements are transmitted.

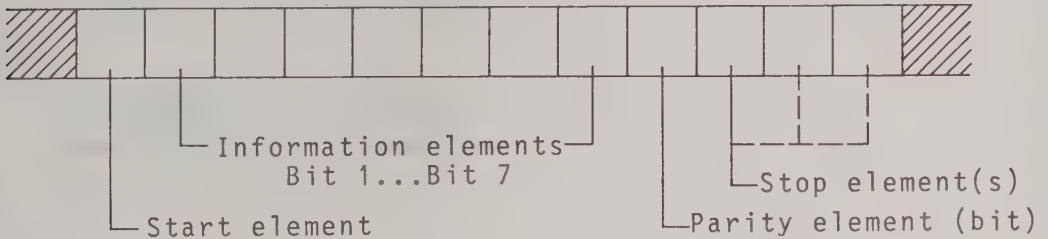


Fig. 7/1 Character structure for bit-serial data transfer

When data are transferred in parallel, a separate data line must be provided for each bit of a character and for the parity bit. The characters issued in parallel are synchronized via signal lines.

7.1 V.24/V.28/RS-232-C interface (SAP-S1)

Fig. 7/2 shows the various possibilities of connecting the PT 88/ PT 89 via the SAP-S1 to different transmitting stations.

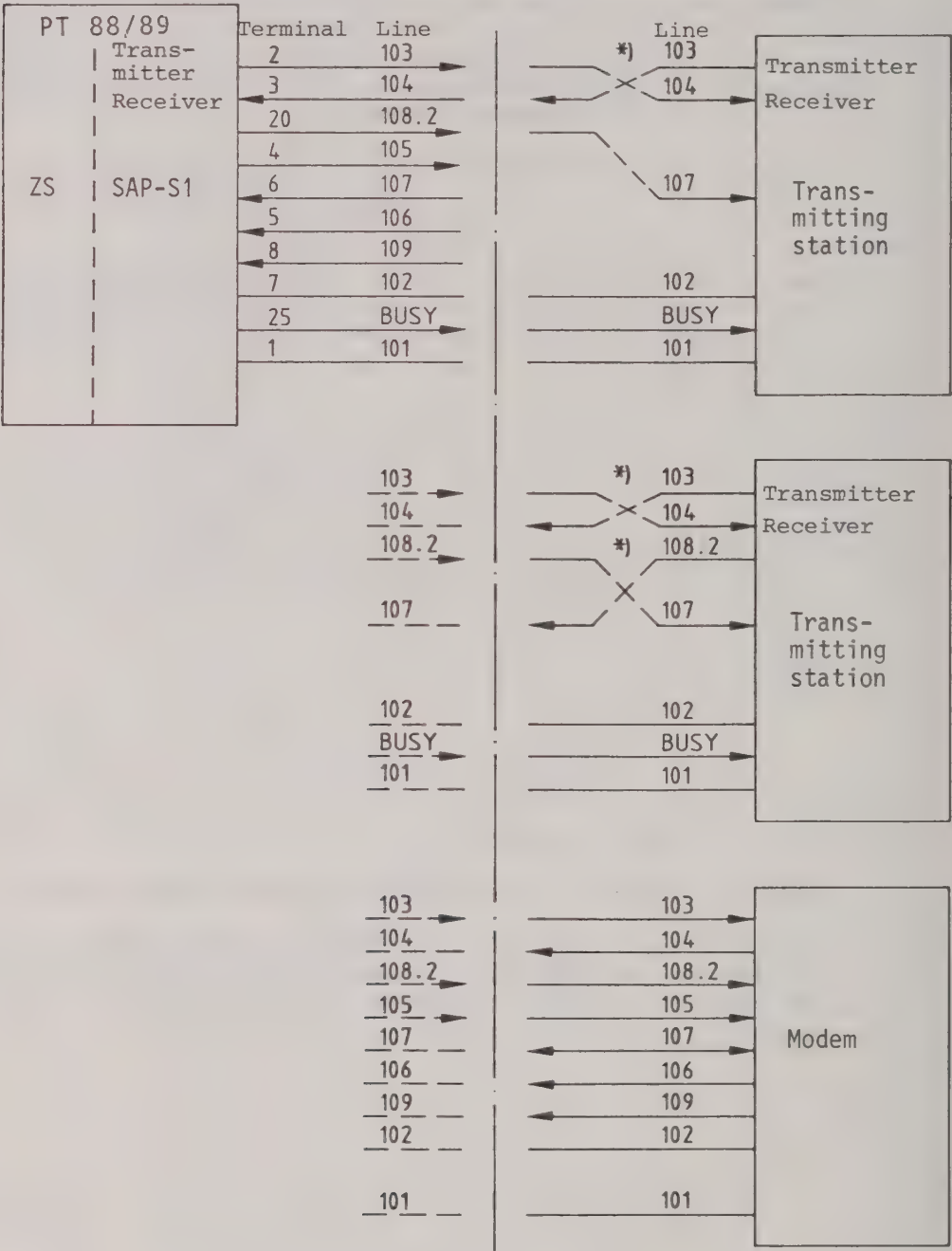


Fig. 7/2 Connection via the SAP-S1

***) Note:**

With direct connection to a transmitting station, ensure that lines 103 and 104 of the printer are crossed with lines 103 and 104 of the transmitting station.
The same applies to line 108.2 and line 107.

7.1.1 Electrical characteristic data

- Maximum permissible line length: 100 ft (30 m)

- Definitions of the signal levels on the interface lines:

Lines	Signal level	Binary state
Data lines 103 and 104	$U \geq +3 \text{ V}$ $U \leq -3 \text{ V}$	"0" (start polarity) "1" (stop polarity)
Control lines 105 and 108.2 signal lines 106, 107 and 109	$U \geq +3 \text{ V}$ $U \leq -3 \text{ V}$	ON state OFF state
BUSY *)	$U \geq +3 \text{ V}$ $U \leq -3 \text{ V}$	Switch setting (see section 7.1.5) S1.5 $\rightarrow$ OFF S1.5 $\rightarrow$ ON S1.6 $\rightarrow$ ON S1.6 $\rightarrow$ OFF
		ready to receive not ready to receive not ready to receive ready to receive

*) The assignment of the signal levels also applies if the BUSY signal is transmitted over line 103.

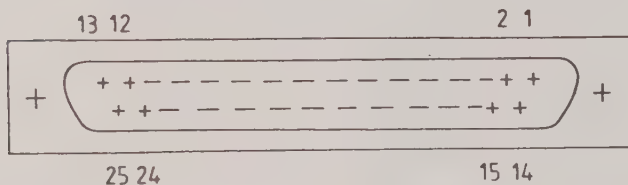
7.1.2 Connecting cable (Asl)

SAP-S1 Plug connector X1.	Connecting cable e.g. Asl 131	Brief designations as per		Signal designations as per
		CCITT V.24	EIA RS-232-C	
				CCITT V.24 and EIA
2	2	103	BA	Transmitted Data
3	3	104	BB	Received Data
20	20	108.2	CD	Data Terminal Ready
4	4	105	CA	Request to Send
6	6	107	CC	Data Set Ready
5	5	106	CB	Ready for Sending
8	8	109	CF	Data channel received Line Signal Detector
7	7	102	AB	Signal Ground
25	25	-	-	not ready to receive (signal BUSY) *)
1	1	101	GND	Protective Ground

25-point Cannon connector

*) Not in accordance
with standard specified

Cannon® connector



Ordering designations

Connector with pin contact strip: V22121-A225-A1
 Connector with female contact strip: V22121-A225-A3
 Cable (LiYCY 12x1x0,14 gr): V45581-B121-A5
 Asl 131, 5 ft (1.5 m) in length: V22112-A12-A37
 (connector with female contact strip to transmitting station)
 Asl 133, 5 ft (1.5 m) in length: V22112-A12-A38
 (connector with pin contact strip to transmitting station)

7.1.3 Output circuit (transmitter, Fig. 7/3)
and input circuit (receiver, Fig. 7/4)

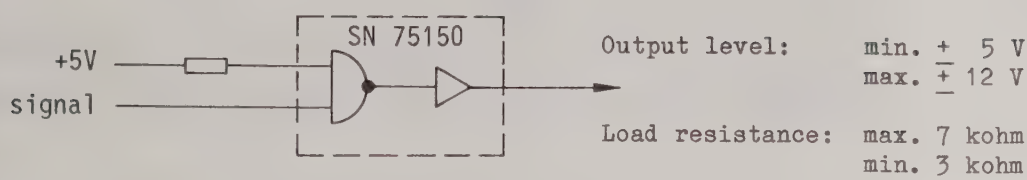


Fig. 7/3 Output circuit for signals 103, 108.2, 105 and BUSY

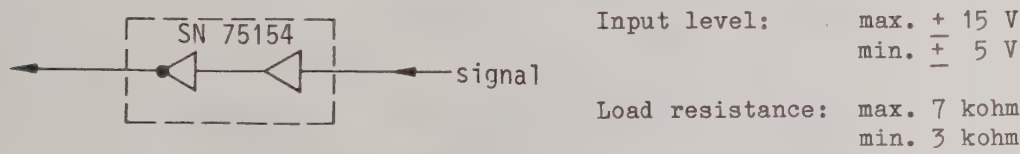


Fig. 7/4 Input circuit for signals 104, 107, 106 and 109

7.1.4 Data flow control

The Printer PT 88/PT 89 and the transmitting station are either connected direct or via modems.

The data flow between the transmitting station and the printer can be controlled by the BUSY signal or with the protocols X-ON/X-OFF and ETX/ACK (switchover via mode switches, see section 7.1.5).

7.1.4.1 Data flow controlled by the BUSY signal

The BUSY signal can be transmitted as required (selectable with switches) over the line

- BUSY or
- 103 "transmitted data" or
- 108.2 "data terminal ready".

The printer transmits the BUSY signal to the transmitting station to indicate whether it is "ready to receive" or "not ready to receive". The BUSY signal can be switched to positive and negative polarity.

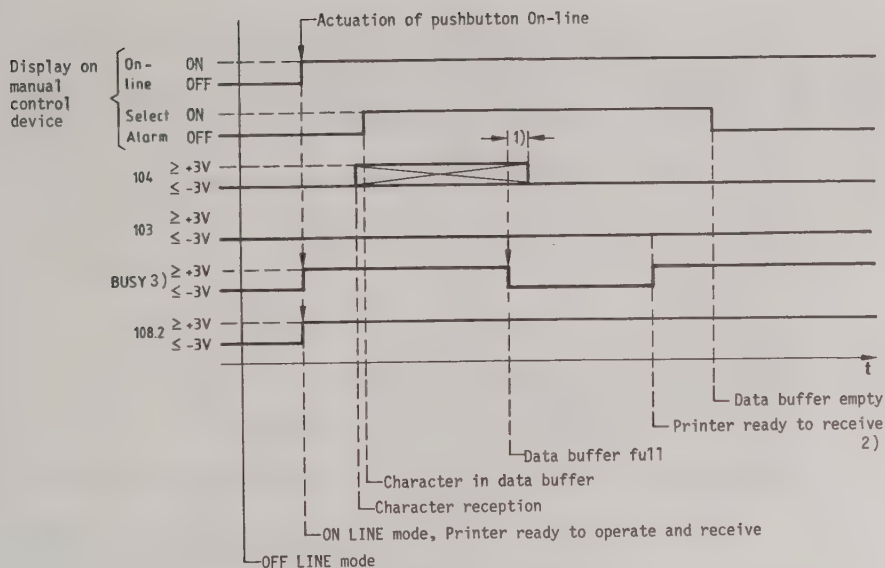
The printer transmits "ready to receive" when the following conditions are satisfied:

- "Power ON" and
- ON-LINE mode and
- receive buffer can accept data (indicated when at least one quarter of the receive buffer capacity is free).

The transmitting station can start the data transmission.

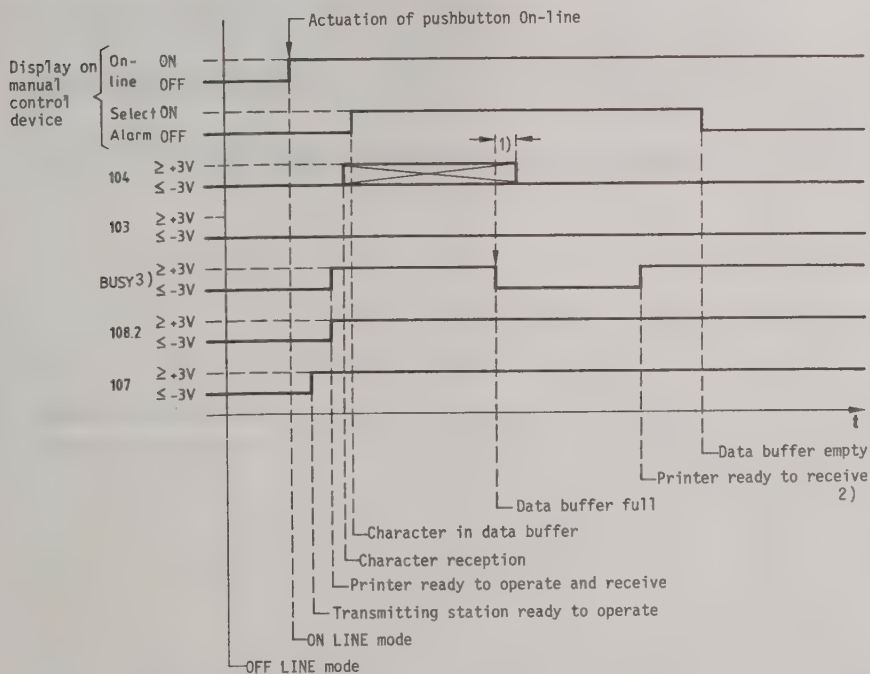
The printer transmits "not ready to receive":

- 20 characters before its receive buffer is full or
- 255 characters before the receive buffer is full, when the receive buffer is larger than 2 Kbytes or
- when a fault condition occurs (contents of receive buffer are retained) or
- on switching to the OFF-LINE mode (actuation of ON-LINE pushbutton).



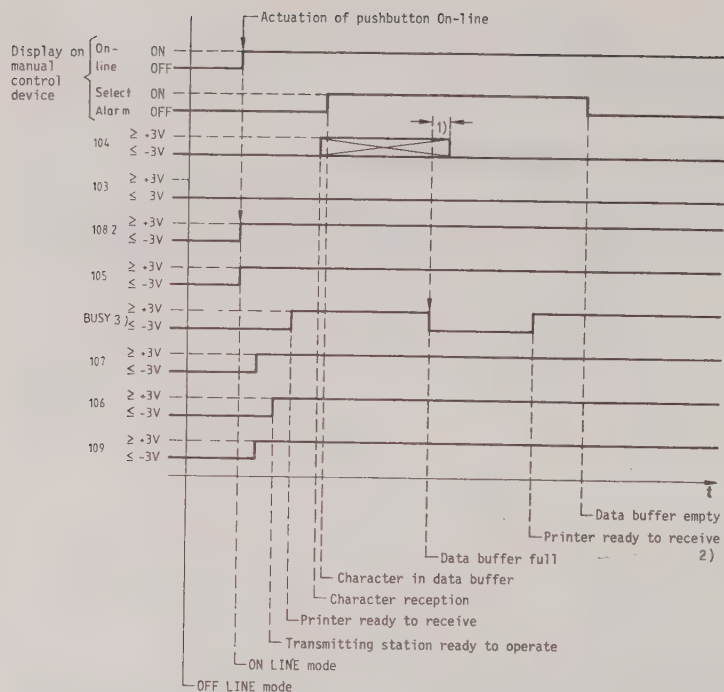
- 1) A maximum of 20 (255 with > 2 Kbytes) characters can be received.
- 2) Is indicated when at least one quarter of the receive buffer capacity is free.
- 3) BUSY signal can also be inverted, and transmitted over line 103 or 108.2.

Fig. 7/5 Interface diagram for operation via lines 103, 104, 108.2 and BUSY



- 1) A maximum of 20 (255 with > 2 Kbytes) characters can be received.
- 2) Is indicated when at least one quarter of the receive buffer capacity is free.
- 3) BUSY signal can also be inverted, and transmitted over line 103.

Fig. 7/6 Interface diagram for operation via lines 103, 104, 107, 108.2 and BUSY



- 1) A maximum of 20 (255 with > 2 Kbytes) characters can be received.
- 2) Is indicated when at least one quarter of the receive buffer capacity is free.
- 3) BUSY signal can be inverted, and transmitted over line 103.

Fig. 7/7 Interface diagram for modem operation

7.1.4.2 Data flow controlled with protocol X-ON/X-OFF

When this protocol is used, data flow is controlled with control characters DC1 (= X-ON) and DC3 (= X-OFF). The printer transmits the control character DC1 to the transmitting station when it is "ready to receive", i.e. when the following conditions are satisfied:

- "Power ON" and
- ON-LINE mode and
- receive buffer can accept data (indicated when at least one quarter of the receive buffer capacity is free).

The transmitting station can start the data transmission.

The printer transmits the control character DC3 "not ready to receive":

- 20 characters before its receive buffer is full or
- 255 characters before the receive buffer is full, when the receive buffer is larger than 2 Kbytes) or
- when a fault condition occurs
(contents of receive buffer are retained) or
- on switching to the OFF-LINE mode
(actuation of ON-LINE pushbutton).

The control characters are always transmitted in the sequence DC1, DC3, DC1, DC3 etc. An exception is when data are received in the OFF-LINE mode whereupon DC3 is again transmitted with "buffer full".

7.1.4.3 Protocol ETX/ACK

Within the framework of the X-ON/X-OFF protocol, the protocol ETX/ACK can also be used.

When the ETX/ACK protocol is used, the received data are transferred as data blocks, which are closed with the control character ETX. The length of the data blocks depends on the capacity of the receive buffer. It must be selected so that no "Receive buffer full" (BUSY signal) occurs. The transmitting station does not transmit the next data block until the printer has issued the control character ACK.

If the transmitting station transmits several data blocks in turn without waiting for the ACK acknowledgement, the control character ACK is only transmitted once, namely when the data block is printed out and the receive buffer is empty.

7.1.5 Mode switch settings

The following table shows the settings of mode switches S1 and S2 required for the various modes. Fig. 7/8 shows the position of the mode switches on the SAP-S1.

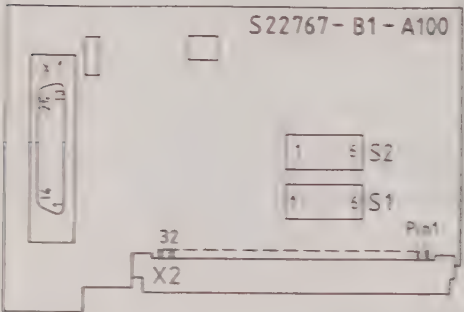


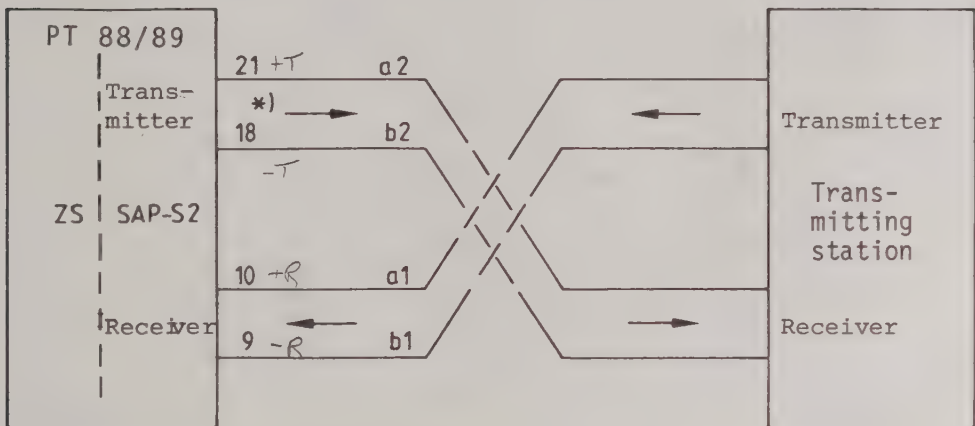
Fig. 7/8 Position of mode switches S1 and S2 on the SAP-S1

CLOSED = ON

Mode		Switch S1.						Switch S2.					
		1	2	3	4	5	6	1	2	3	4	5	6
Data rate bit/s	110	OFF	OFF	OFF									
	200	ON	OFF	OFF									
	300	OFF	ON	OFF									
	600	ON	ON	OFF									
	1200	OFF	OFF	ON									
	2400	ON	OFF	ON									
	4800	OFF	ON	ON									
	9600	ON	ON	ON									
Operation with	line 103, 104, 106.2				OFF	OFF	ON	OFF	ON	OFF	ON	OFF	OFF
X-ON/X-OFF	line 103, 104, 106.2, 107				ON	OFF	ON	OFF	ON	OFF	ON	OFF	OFF
protocol	modem				OFF	ON	ON	OFF	ON	OFF	ON	OFF	OFF
Operation with	line 103, 104, 106.2, BUSY				OFF	OFF	OFF						
with	line 103, 104, 106.2, 207, BUSY				ON	OFF	OFF						
BUSY signal	modem				OFF	ON	OFF						
BUSY line	line BUSY (X1.25)							OFF	ON	OFF	ON		
X1.10	line 103 (X1.2)							OFF	ON	ON	OFF		
connected to	line 106.2 (X1.20)							ON	OFF	OFF	ON		
Signal BUSY at X1.25 (X1.2, X1.20)	neg. potential											OFF	ON
not ready to receive B	pos. potential											ON	OFF

7.2 TTY interface/20 mA current loop (SAP-S2)

The connection of the Printer PT 88/PT 89 via the SAP-S2 to the transmitting station is shown in Fig. 7/9.



*) In operation with the BUSY signal, it is transmitted over the send line.

Fig. 7/9 Connection of Printer PT 88/PT 89 via TTY interface

7.2.1 Electrical characteristic data

Maximum permissible line length: 100 ft (30 m)
(transmitting station with similar electrical data)

Internal power source (line fed by printer)

- Operating voltage: + 12 V (positive pole to a2 or a1)
- Line current: 20 mA
- Output voltage at 20 mA
Transmitter: approx. 3 V Receiver: approx. 3 V
- No conductive isolation of the send and receive circuits.
- Resistant to short circuits.

External power source (line fed externally)

- Operating voltage: 20 to 48 V
- Line current: 20 mA
- Maximum permissible current: 80 mA
- Voltage drop at 20 mA (without protective resistor)
Transmitter: approx. 3 V Receiver: approx. 3 V
- Transmitter and receiver are not dependent on polarity.
- Conductive isolation of the send and receive circuits.

Level assignment

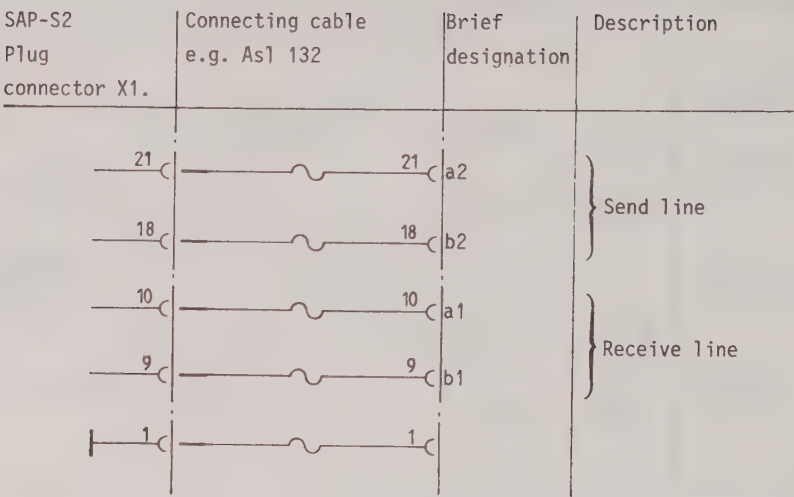
Data lines

- Current: stop polarity
- No current: start polarity

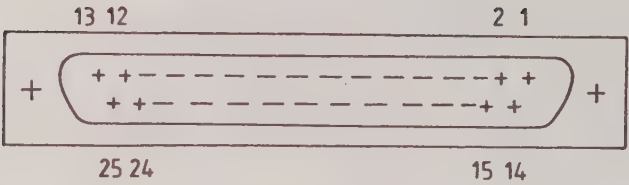
BUSY signal	S1.4 = OFF S1.7 = ON S1.5 = OFF S1.8 = OFF	S1.4 = OFF S1.7 = OFF S1.5 = OFF S1.8 = ON
Current:	ready to receive	not ready to receive
No current:	not ready to receive	ready to receive

See section 7.2.5 for switch settings

7.2.2 Connecting cable (As1)



Cannon® connector



Ordering designations

- Connector with pin contact strip: V22121-A225-A5
- Connector with female contact strip: V22121-A225-A7
- Cable (4 DIN 47414 gr.): D47414-A421
- As1 132, 5 ft (1.5 m) in length: V22111-A8-A133
(connector with female contact strip to transmitting station)
- As1 134, 5 ft (1.5 m) in length: V22111-A8-A134
(connector with pin contact strip to transmitting station;
pin 7 and pin 14 are connected via a strap)

Note: To ensure that the degree of RF suppression is adhered to, and with line lengths 15 m, a screened connecting cable is required (available on request).

7.2.3 Output circuit (transmitter, Fig. 7/10)
and input circuit (receiver, Fig. 7/11)

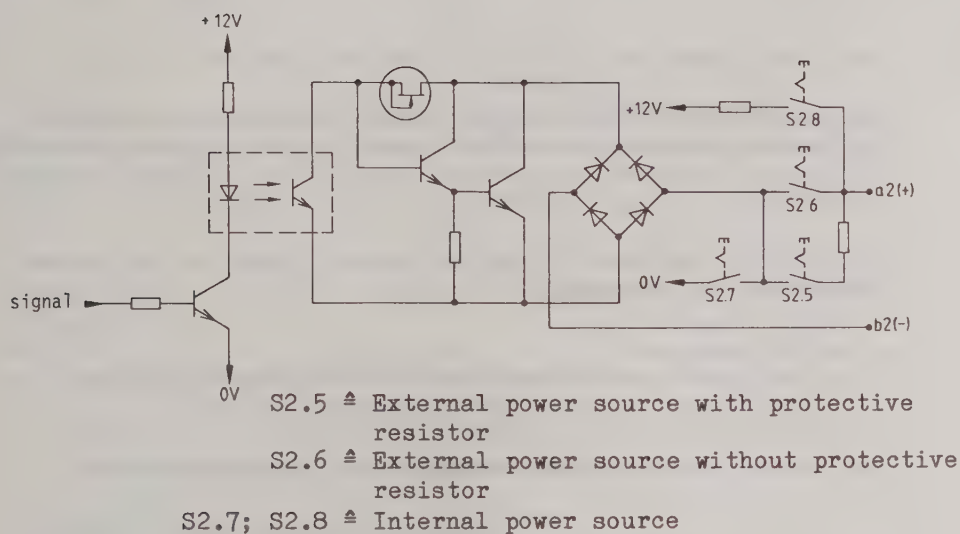


Fig. 7/10 TTY transmitter

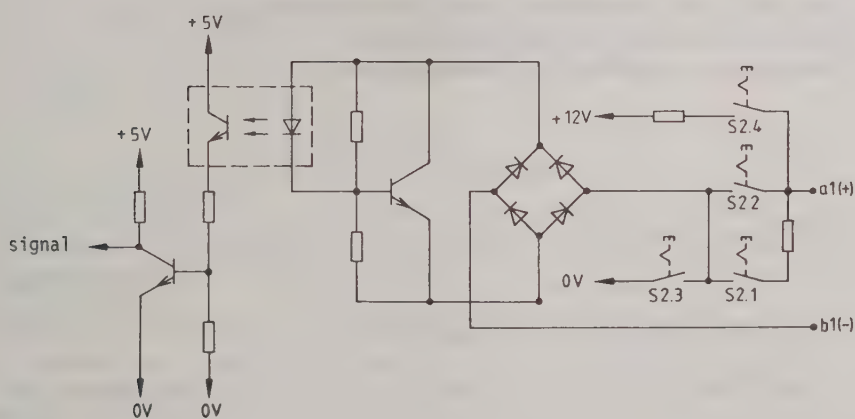


Fig. 7/11 TTY receiver

7.2.4 Data flow control

The Printer PT 88/PT 89 and the transmitting station are directly connected.

The data flow between the transmitting station and the printer can be controlled by the BUSY signal or with the protocols X-ON/X-OFF and ETX/ACK (see section 7.2.5 for switchover via the mode switches).

7.2.4.1 Data flow controlled by the BUSY signal

The BUSY signal is transmitted over the send line (a2, b2). The printer transmits the BUSY signal to the transmitting station to indicate whether it is "ready to receive" or "not ready to receive".

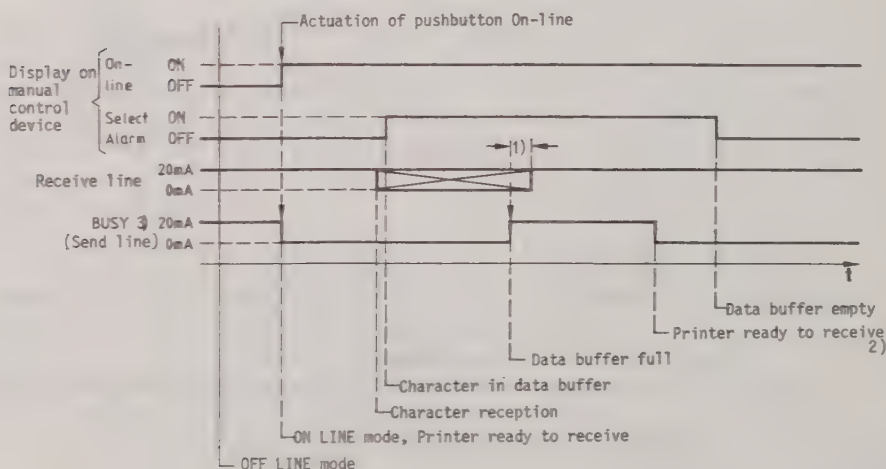
The printer transmits "ready to receive" when the following conditions are satisfied:

- "Power ON" and
- ON-LINE mode and
- receive buffer can accept data (indicated when at least one quarter of the receive buffer capacity is free).

The transmitting station can start the data transmission.

The printer transmits "not ready to receive":

- 20 characters before its receive buffer is full or
- 255 characters before the receive buffer is full, when the receive buffer is larger than 2 Kbytes or
- when a fault condition occurs (contents of receive buffer are retained) or
- on switching to the OFF-LINE mode (actuation of ON-LINE pushbutton).



- 1) A maximum of 20 (255 with > 2 Kbytes) characters can be received.
- 2) Is indicated when at least one quarter of the receive buffer capacity is free.
- 3) BUSY signal can also be inverted.

Fig. 7/12 Interface diagram for operation via the TTY interface

7.2.4.2 Data flow controlled with protocol X-ON/X-OFF

When this protocol is used, data flow is controlled with control characters DC1 (= X-ON) and DC3 (= X-OFF). The printer transmits the control character DC1 to the transmitting station when it is "ready to receive", i.e. when the following conditions are satisfied:

- "Power ON" and
- ON-LINE mode and
- receive buffer can accept data (is indicated when at least one quarter of the receive buffer capacity is free).

The transmitting station can start the data transmission.

The printer transmits the control character DC3 "not ready to receive":

- 20 characters before its receive buffer is full or
- 255 characters before the receive buffer is full, when the receive buffer is larger than 2 Kbytes or
- when a fault condition occurs
(contents of receive buffer are retained) or
- on switching to the OFF-LINE mode
(actuation of ON-LINE pushbutton).

The control characters are always transmitted in the sequence DC1, DC3, DC1, DC3 etc. An exception is when data are received in the OFF-LINE mode whereupon DC3 is transmitted again with "buffer full".

7.2.4.3 Protocol ETX/ACK

Within the framework of the X-ON/X-OFF protocol, the protocol ETX/ACK can also be used.

When the ETX/ACK protocol is used, the received data are transferred as data blocks, which are closed with the control character ETX. The length of the data blocks depends on the capacity of the receive buffer. It must be selected so that no "Receive buffer full" (BUSY signal) occurs. The transmitting station does not transmit the next data block until the printer has issued the control character ACK.

If the transmitting station transmits several data blocks in turn without waiting for the ACK acknowledgement, the control character ACK is only transmitted once, namely when the data block is printed out and the receive buffer is empty.

7.2.5 Mode switch settings

The following table shows the settings of mode switches S1 and S2 required for the various modes. Fig. 7/13 shows the position of the mode switches on the SAP-S2.

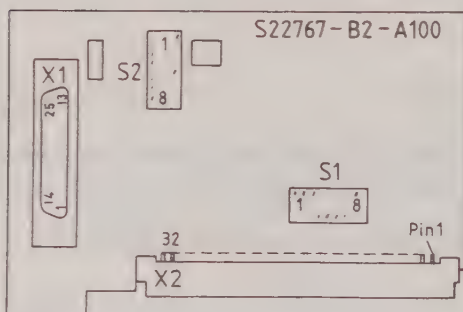


Fig. 7/13 Position of mode switches S1 and S2 on the SAP-S2

CLOSED = ON

Mode		Switch S1.								Switch S2.							
		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Data rate bit/s	110	OFF	OFF	OFF													
	200	ON	OFF	OFF													
	300	OFF	ON	OFF													
	600	ON	ON	OFF													
	1200	OFF	OFF	ON													
	2400	ON	OFF	ON													
	4800	OFF	ON	ON													
	✓ 9600	ON	ON	ON													
Operation with X-ON/X-OFF protocol					ON	OFF	ON	OFF	OFF								
Operation with "not ready to receive" = current					OFF	OFF	OFF	ON	OFF								
(BUSY line connected to send line) "not ready to receive" = no current					OFF	OFF	OFF	OFF	ON								
Internal power source										OFF	OFF	ON	ON	OFF	OFF	ON	ON
External power source with protective resistor										ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
External power source without protective resistor										OFF	ON	OFF	OFF	OFF	ON	OFF	OFF

7.3 Centronics® interface (SAP-P1)

The connection of the Printer PT 88/PT 89 via the SAP-P1 to the transmitting station is shown in Fig. 7/14.

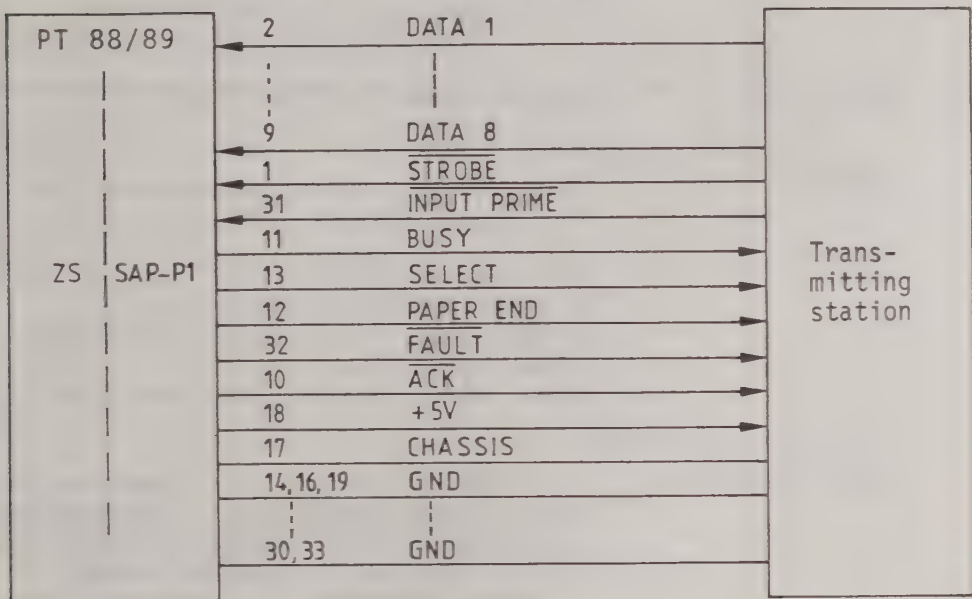


Fig. 7/14 Connection of the Printer PT 88/PT 89 via the Centronics® interface

7.3.1 Electrical characteristic data

Maximum permissible line length: 20 ft (6 m)

The data and control signals are transmitted on the interface lines using TTL level.

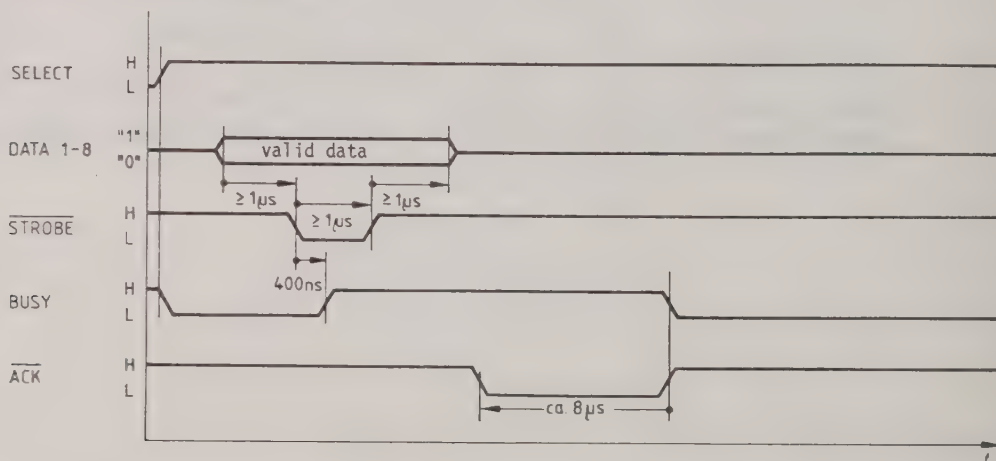
Level assignment:

	Low (log. "0")	High (log. "1")
Output values	$\leq +0.4 \text{ V}$	$\geq +2.4 \text{ V}$
Input values	$\leq +0.8 \text{ V}$	$\geq +2 \text{ V}$

7.3.2 Description of the data and control signals

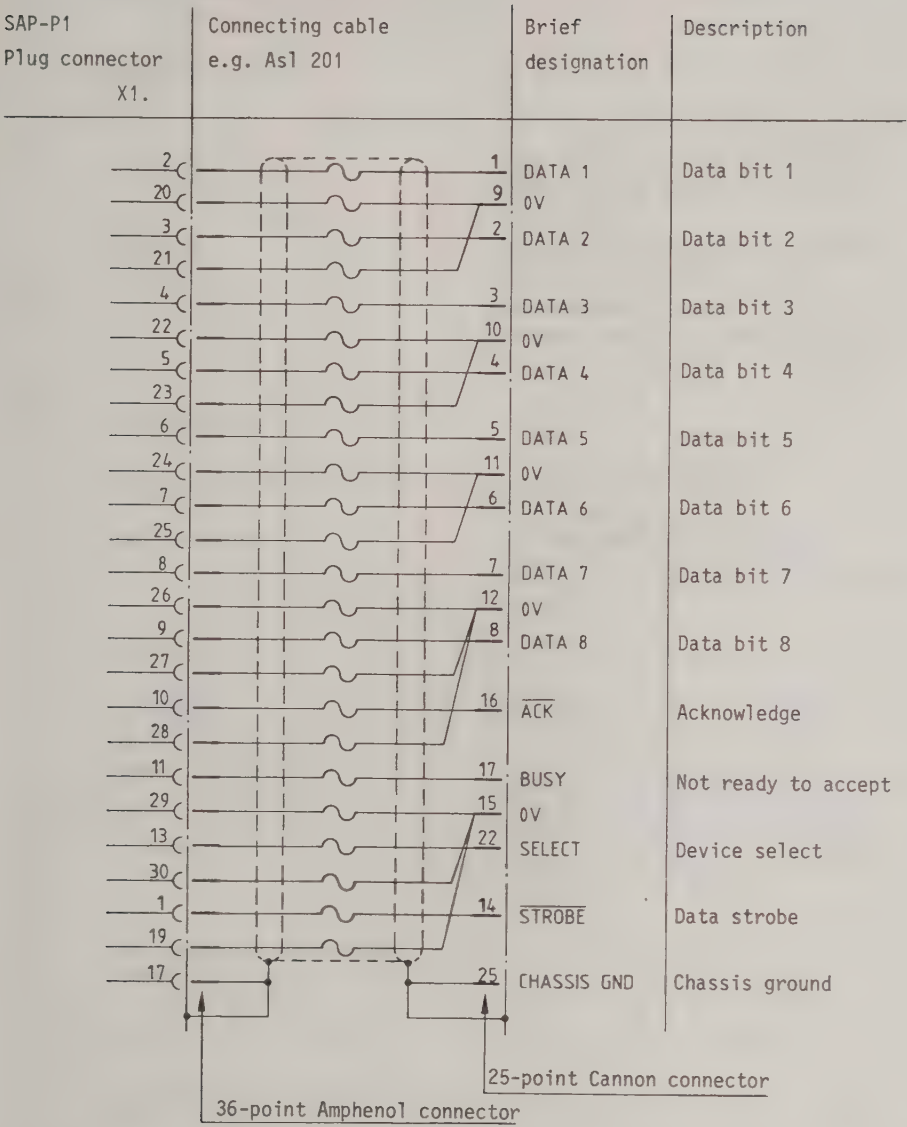
Signal name	Function
SELECT	This signal indicates the printer status to the transmitting station: High = printer in ON-LINE mode Low = printer not in ON-LINE mode (OFF-LINE mode, fault, test mode)
DATA 1...8	Receive lines for data bits 1 to 8
STROBE	This is the synchronization signal for data signal transfer (data bits 1 to 8)
BUSY	When this signal is active there is no data transfer in response to the STROBE signal. The signal is high when: - the receive buffer is full, - the SELECT signal is low (inactive).
ACK = ACKNOWLEDGE	The printer transmits this signal to the transmitting station when it has received and processed the character. It indicates that the printer is ready to receive a further character.
PAPER END	This signal indicates to the transmitting station that paper and/or ink are exhausted. Data are not accepted.
FAULT	(FAULT is the inverted PAPER END signal.)
INPUT PRIME	The application of the low level for at least 50 μ s resets the printer.
+5 V	For external connection of an adapter, max. load 300 mA.

7.3.3 Signal timing diagram

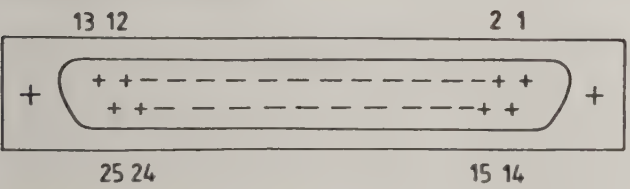


*) On actuation of the ON-LINE pushbutton or in a fault condition the BUSY signal is set asynchronously to data transfer.

7.3.4 Connecting cable (Asl)



Cannon® connector

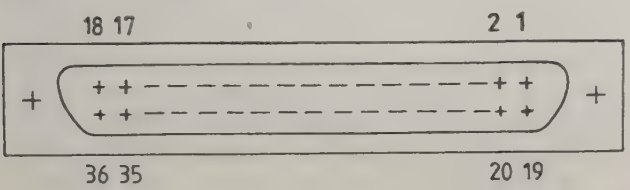


Ordering designations

Connector with 36-pin
pin contact strip:
C26334-Z14-C11

Connector with 25-pin
pin contact strip:
V22121-A225-A1

Amphenol® connector



Cable (LiYCY 16x2x0,09 sw):
V45481-A162-A15

Asl 201, 5 ft (1.5 m)
V22112-A27-A1

Other connecting cables
on request.

Data transfer

Code	ISO 7-bit code, IA No. 5, ASCII
Data rate serial	110, 200, 300, 600, 1200, 2400, 4800, 9600 bit/s
parallel	2000 cps
Parity	Even, odd, no parity check
Protocol	ETX/ACK, XON/XOFF, BUSY
Data buffer	165 characters (expansion to a maximum of 4 KB possible)

Interfaces

Serial (asynchronous)	V.24/V.28 or RS-232-C TTY 20 mA
Parallel	Centronics®-type 8-bit (further interfaces on request)

Printing

Method	Ink-jet or needle printing
Print matrix	Character generator (ROM) 9 by 9 (5 + 4 columns by 9 traces) Loadable character generator (RAM) 12 by 9 Graphics: 8 traces per path (bit-image printing)
Character dimensions (with 10 cpi)	0.1 x 0.8" (2.5 x 2.1 mm)
Dot matrix vertical	72 dpi (2.8 dots/mm)
Dot matrix horizontal	
Dot density	60, 72, 102 dpi (2.4, 2.8, 4 dots/mm)
Print direction	Bidirectional printing (optimized)

Ink-jet printing

Operating noise	≤ 50 dB (A)		
Printing speed	150 cps		
Print rate (with 10 cpi)	20 char./line	approx. 55 cps	165 lines/min
	40 char./line	approx. 80 cps	120 lines/min
	60 char./line	approx. 95 cps	95 lines/min
	80 char./line	approx. 105 cps	80 lines/min
	136 char./line	approx. 120 cps	55 lines/min
Useful life of print head	Practically unlimited (no moving parts during printing)		
Ink	Black, lightfast, indelible		

Ink supply	Ink cartridge, easily replaceable by operator, sufficient for approx. 5×10^6 characters (with an average of 10 dots/character)		
<u>Needle printing</u>			
Operating noise	≤ 60 dB (A)		
Printing speed	80 cps		
Print rate (with 10 cpi)	20 char./line	approx. 45 cps	135 lines/min
	40 char./line	approx. 55 cps	85 lines/min
	60 char./line	approx. 65 cps	65 lines/min
	80 char./line	approx. 70 cps	55 lines/min
	136 char./line	approx. 75 cps	33 lines/min
Useful life of print head	100×10^6 characters (typical value)		
Number of plies	1 original and 2 copies (using carbon paper) With special paper, more copies can be produced		
Ribbon	Useful life of 3.5×10^6 characters		
<u>Character spacing</u>			
Standard print	10, 12, 17 cpi		
Expanded print	5, 6, 8.5 cpi (by doubling the matrix dots)		
<u>Paper feed</u>			
Drive system	Margin-perforated continuous forms using tractor		
	Single sheets		
	Roll paper (only PT 88) using friction drive with pressure rollers		
Line spacing	6 or 8 lines/inch adaptable or programmable in steps from 1/72" to 99/72"		
Slew rate	Approx. 135 ms/line (1/6")		
<u>Paper and ink monitoring</u>	Signal via the interface and "ALARM" display flashes on the manual control device and audible alarm sounds		

<u>Paper dimensions</u>		PT 88	PT 89
Fanfold paper		5" to 9 7/8" (124 to 250 mm)	5" to 15 3/4" (124 to 400 mm)
Single sheets		4 1/8" to 8 1/2" (105 to 216 mm)	4 1/8" to 15 3/4" (105 to 400 mm)
Diameter of roll paper		5" max. (127 mm)	
Paper weight		16 to 27 lb bond (60 to 100 g/m ²) (up to 34 lb bond (130 g/m ²) in special cases) Single- and multi-part paper, depending on version. Special paper should be tested before use.	
<u>Controllable functions in the basic printer</u>		(via control characters as per ISO DIS 6429, DIN 66203, ECMA 35)	
Print head movement		Character spacing 10 or 5 cpi Character spacing 12 or 6 cpi Character spacing 17 or 8.5 cpi Expanded print ON/OFF Insert filler steps Space Carriage return Set horizontal tabulator Clear horizontal tabulator Start horizontal tabulator Underlining ON/OFF Program first and last print position	
Paper movement		Line feed Half-line forward Half-line backward Program line spacing Set vertical tabulator Clear vertical tabulator Start vertical tabulator Form feed Program form length Program first and last print line	
Character generator		8 character sets International (IA No. 5) ASCII English French/Belgian Swedish/Finnish Danish/Norwegian Spanish German	
Graphics printing		Bit-image method (8-bit)	
General		Bell Reset printer Reset parameters	

Interface protocol

```
Printer ready to receive
Printer not ready to receive
(via BUSY status line)
XON/XOFF
ETX/ACK
```

Power

Power voltage	$\begin{matrix} +10 \\ 220 \text{ V ac } -15 \% \text{ adaptable to } 240 \text{ V ac } -15 \%, \end{matrix}$ $\begin{matrix} 0.4 \text{ A slow-blow fuse} \\ \text{or} \end{matrix}$ $\begin{matrix} +10 \\ 117 \text{ V ac } -15 \% \text{ adaptable to } 127 \text{ V ac } -15 \%, \end{matrix}$ $\begin{matrix} 0.8 \text{ A slow-blow fuse} \end{matrix}$
Power frequency	$\begin{matrix} 50 \text{ Hz } +5\% \text{ at } 220 \text{ V / } 240 \text{ V ac} \\ 60 \text{ Hz } +5\% \text{ at } 117 \text{ V / } 127 \text{ V ac} \end{matrix}$
Power draw	$\begin{matrix} \text{Approx. } 20 \text{ W in standby condition} \\ \text{Approx. } 30 \text{ W during printing} \end{matrix}$
RF suppression	$\begin{matrix} \text{Limit value category B, VDE 0871} \\ \text{FCC 79-555} \end{matrix}$
Electrical safety	
- Class of protection	$\begin{matrix} \text{Class of protection 2} \\ \text{DIN IEC 380/VDE 0806; UL 114/478} \end{matrix}$

Environmental conditions

	Operation	Storage/transport
Temperature	+50°F to +104°F (+10°C to + 40°C)	-12°F to +158°F (-25°C to + 70°C)
Humidity relative	10% to 90%	10% to 90%
absolute	no condensation ≤ 25 g/m ³	no condensation ≤ 25 g/m ³
Low pressure	> 600 millibars (3500 m above M.S.L.)	> 350 millibars (6500 m above M.S.L.)

Reliability

Printer (MTBF)	5000 hours (power ON)
	1500 hours (printing)
(MTTR)	20 minutes

Testing

Test program	Printout of all characters of the standard character generator; activation/deactivation via pushbuttons
--------------	---

Physical data

Dimensions	PT 88	PT 89
Width	16 1/8" (410 mm)	23" (585 mm)
Depth	12 1/4" (309 mm)	12 1/3" (313 mm)
(with roll paper)	18 1/2" (474 mm)	
Height	5 1/2" (140 mm)	6" (148 mm)
Weight (approx.)	17 lbs (7,5 kg)	22 lbs (10 kg)
Operating position	any inclination up to 7°	

Pull the power connector before opening the printer.

9.1 Fault diagnosis

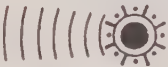
The following table lists some malfunctions which may occur and the probable causes. Such malfunctions should be remedied by the operator. If a malfunction cannot be localized and eliminated with the aid of the table, the printer must be examined by qualified service personnel.

On account of the safety requirements, repair work in the printer may only be performed by qualified personnel. If the work is not performed by qualified personnel, the guarantee expires.

The LED displays on the manual control device and an audible signal indicate the operating status. The significance of the symbols is as follows:

 = display dark
  = display illuminated
  = display flashes

Status indicated	Trouble	Probable cause/ remedy by operator	Section
<u>Power OFF</u> POWER  SELECT  ON-LINE 	No display and no synchronization run after "Power ON"	Power cable not plugged in No power Defective fuse	3 9.3
ON-LINE 	Synchronization run but no display	Manual control device not plugged in	4.1
<u>OFF-LINE</u> POWER  SELECT  ON-LINE 	Printer cannot be switched to "ON-LINE" mode by "ON-LINE" pushbutton	Printer is still in inter- rupted test mode (e.g. to wash out print head chan- nels, see section 9.2)	3.3
<u>ON-LINE</u> POWER  SELECT  ON-LINE 	Printer receives no data	Data cable not plugged in Printer signals BUSY, e.g. due to incorrect setting of coding switch on SAP	4.4 7.1.5 7.2.5

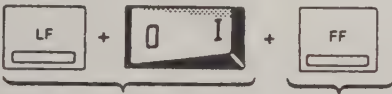
Status indicated	Trouble	Probable cause/ remedy by operator	Section
<u>ON-LINE</u> POWER  SELECT  ON-LINE 	Printing of smudge characters and/or incorrect data characters and functions not performed or performed incorrectly	Incorrect coding switch settings such as: - Incorrect parity (on ZS) - Incorrect data rate (SAP) Data cable defective	4.3 7.1.5 7.2.5
	Poor print quality	Needle printer ribbon requires replacement	5.6.2
		End of useful life of needle print head	9.4
		Print head gap not set correctly	5.4
		Ink nozzles dirty (should be washed out)	9.2
	Paper is not transported properly	Paper pressure arm not latched in forward position	5.5.1
		With roll paper, pressure lever not raised	5.5.4
		Paper roll inserted incorrectly	5.5.4
<u>Malfunction</u> POWER   ALARM ON-LINE 	ALARM display flashes and audible alarm sounds to indicate malfunction	End of paper Ink exhausted Printer carriage blocked (e.g. by paper jam)	5.5 5.6 *)

*) In this case the printer must be deactivated when performing troubleshooting. Data in the buffer is deleted.

9.2 Washing out the ink-jet print head

External influences (e.g. contamination of the ink nozzles with paper dust) can lead to poor print quality or to failure of ink nozzles. This can be remedied by washing out the print head channels. There are two possible methods.

Note: The ink cartridge may not be replaced while the print head is being washed out.

Test mode	ON-LINE/OFF-LINE mode
- Activate test mode - Hold the LF pushbutton down and switch on power. Text is printed.  - Test mode Washing out - Interrupt test mode with the FF pushbutton (washing out).	- Press ON-LINE and FF pushbuttons simultaneously  Washing out - If printing is in progress, it is stopped, the positive seal remains open for 3 minutes (washing out). During this time the ALARM display flashes.
- Raise front cover lid. - Raise lid ① (Fig. 9/1) to prevent ink from being ejected onto the paper. - With the lid raised, press down evenly for 3 to 5 seconds on the membrane ② of the ink cartridge past the point where resistance is felt. - Release lid ① (springs back to home position).	
- Switch back to test mode with the LF pushbutton and check print quality. - Repeat washing out if necessary. - Deactivate test mode via "Power OFF".	- Restore printer to ON-LINE mode with ON-LINE pushbutton. Printing can be continued. If there are data in the buffer, they are printed out.

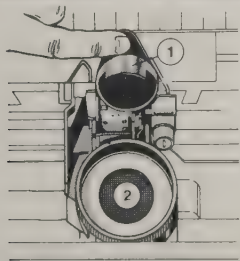


Fig. 9/1 Ink-jet print head

Note: The amount of ink the tampon in the ink cartridge can absorb is limited. It suffices about 10 washing out operations. For reshipment the container should be wiped clean. For this purpose, the ink cartridge must be removed.

9.3 Fuse replacement

- Switch off printer.
- Pull power cable.
- Note line voltage (see also section 3.1, Fig. 3/2).
- Remove fuse holder (Fig 9/2) as per section 3.1.

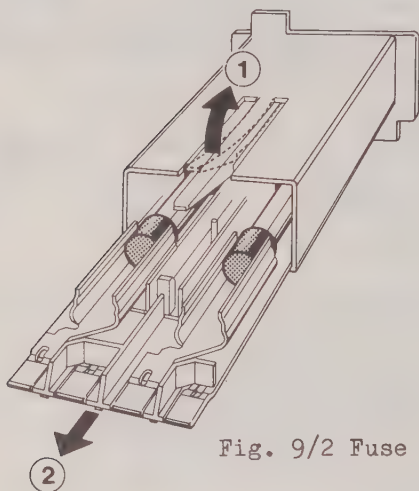


Fig. 9/2 Fuse holder

- Raise catch (1, Fig. 9/2) and withdraw holder body (2).
- Replace defective fuse.

Line voltage	117/127 V ac	220/240 V ac
<u>Fine</u> fuse	0.8 A medium delay US Standard 1/4" x 1 1/4" 6.3 x 32 mm	0.4 A medium delay DIN 41 571 5 x 20 mm

WARNING! For continued protection against fire hazard, replace only with the same type and rating of fuse.

- Replace the holder body and the fuse holder in the reverse order of removal (observe line voltage on fuse holder).

Important note:

If the fuse blows, the cause is frequently a malfunction in the printer. If the fuse blows again, the printer must therefore be examined by qualified service personnel.

9.4 Replacement of the needle print head

To ensure that the printer functions correctly, the needle print head should normally only be replaced by qualified service personnel. In exceptions to this procedure, the following instructions for removal and replacement must be observed.

- Press down the resilient stop of the needle print head fastener (1, Fig. 9/3) with a sharp object (e.g. a pencil) and turn the setting level (2) to the front (in the direction of the platen) until it latches.
- Pull foil cable (3) from the connector on the central control (ZS).
- Lift out needle print head and at the same time relieve strain (4) of the foil cable.

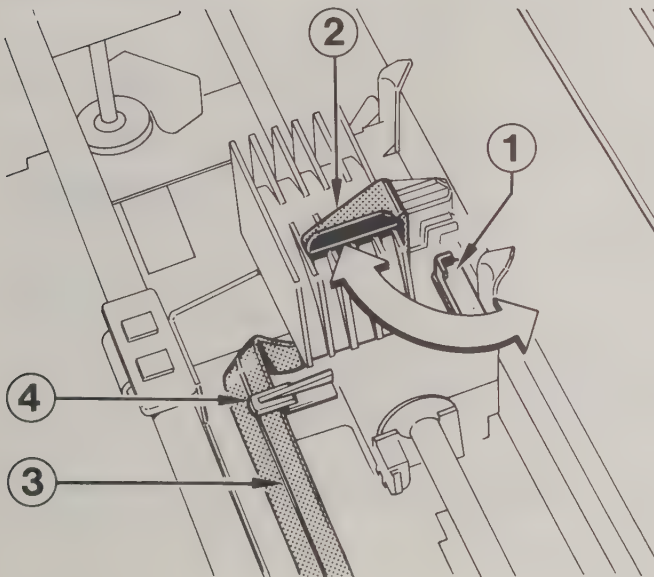


Fig. 9/3 Unlatching the needle print head

- Reverse the sequence of removal when replacing the print head (no not bend foil cable). Setting lever of needle print head fastener latches automatically when it is pressed back.

10 Consumable items

10.1 Paper

Margin-perforated fanfold paper

Paper width:	PT 88	PT 89
	5" to 9 7/8"	5" to 15 3/4"
	(124 mm to 250 mm)	(124 mm to 400 mm)

Dimensions and characteristics: As per DIN 9771, ISO 2784

Fold length: Typically 11" or 12"; other fold lengths (both smaller and larger) are possible

Specifications: Commercially available fanfold paper for ink-jet and/or needle printing (depending on printer version)

High-grade paper for ink-jet printing
see section 10.5

Roll paper (PT 88 only)

Paper width: 4" to 8 1/2" (105 mm to 216 mm)

Dimensions and characteristics: As per DIN 6720

Maximum outer diameter of roll: 5" (127 + 1 mm)

Specifications: Commercially available roll paper for ink-jet and/or needle printing (depending on printer version)

High-grade paper for ink-jet printing
see section 10.5

Single sheets

Paper width:	PT 88	PT 89
	4 1/8" to 8 1/2"	4 1/8" to 15 3/4"
	105 mm to 216 mm	105 mm to 400 mm
Paper length:	5 1/2" (149 mm) min; 11" (298 mm) max.	
Specifications:	Commercially available single-part paper for ink-jet and/or needle printing (depending on the printer version)	
High-grade paper for <u>ink-jet printing</u>	see section 10.5	

10.2 Ribbon

The ribbon cartridge can be easily replaced by the operator.

Useful life of ribbon: 3.5×10^6 characters

Width:	1/2" (13 mm)
Length:	approx. 70 ft (20 m) endless ribbon
Material:	Nylon
Storage:	At least 2 years packed
Supplier:	SIEMENS AG
Ordering no. for PT 88:	S22761-J1-D1 (pack of 5)
	for PT 89: S22761-J1-D2 (pack of 5)
Color:	black

10.3 Ink cartridge

The ink cartridge can be easily replaced by the operator.
Please note that only ink cartridges from Siemens may be used, as otherwise the proper operation of the printer cannot be guaranteed. The ink cartridge cannot be refilled.

Ink supply:	5×10^6 characters with an average of 10 matrix dots per character
Characteristics of the ink:	Indelible, lightfast, waterproof and instant drying
Color:	Black
End of ink:	Monitored by the printer control
Shelf life:	18 months approx., closed Observe "use-by date" on package
Supplier:	SIEMENS AG
Ordering no.:	S22761-J2-D1 (pack of 5)
Color:	Black

10.4 Ordering designations

<u>Basic printer</u>	<u>220/240 V; 50 Hz</u>	<u>117/127 V; 60 Hz</u>
Printer PT 88 ink-jet	S22761-A88-T1	S22761-A88-T2
Printer PT 88 needle	S22761-A88-N1	S22761-A88-N2
Printer PT 89 ink-jet	S22761-A88-T101	S22761-A88-T102
Printer PT 89 needle	S22761-A88-N101	S22761-A88-N102

Interface adapters/data cables

	<u>SAP</u>	<u>Data cable (Cannon® connector)</u>
V.24/V.28, RS-232-C	S22767-B1-A100	V22112-A12-A37 (female contact strip) V22112-A12-A38 (pin contact strip)
TTY 20 mA	S22767-B2-A100	V22111-A8-A133 (female contact strip) V22111-A8-A134 (pin contact strip)
Centronics® type	S22767-B101-A100	V22112-A27-A1 (pin contact strip)

Power cables

Germany	V22113-A2-A213 (non-fused grounding contact)
USA	V22113-A2-A224 (NEMA 1-15 P)

Expansion

Data buffer 4 Kbytes	S22761-L301-B1
Function expansion	On request
- data buffer 1.9 Kbyte + loadable character generator + character generator 2 (ZGB 2)	
- graphics methods: scanner method bit-image method (7 bit)	

<u>Roll holder</u>	<u>S22761-T1-D1</u> (for PT 88 only)
--------------------	--------------------------------------

10.5 Suppliers of special paper for ink-jet printing

Argentina

Rotagráfica Argentina S.A.I.C.
Terrero 3146
Buenos Aires

Tel. 58 66 71

Mr. F. Enrique Cavallero
Mr. Federico Cuesta

Australia

Wilke Business Forms Pty. Ltd.
41 - 45 Lorraine Street
Peakhurst / New South Wales 2210

Tel. 53 07 01
Tx. 25724

Mr. John A. Yabsley

Multiform Printers Pty. Ltd.
P.O. Box 343
(63 - 69 Fairbank Road)
Clayton / Victoria

Tel. 544 18 99
Tx. 30205

Mr. Kevin A. O'Brien
Mr. W.J. Bradbury

Advertiser Newspapers Ltd.
(Continuous Forms Division)
26 Watson Avenue
Netley / South Australia 5037

Tel. 297 47 88
Tx. 89154

Mr. Dean G.S. Thornquest

Belgium

Meurice S.A.
Rue de Tubize 137
1440 Braine-le-Château

Tel. 236 699 60
Tx. 24894

Mr. Paul Petre

Brazil

Continac SA
Rua Araujo
Porto Allegre 36-6°
Rio de Janeiro

Tel. 220 01 22
Tx. 2121579

Mr. Victor C. Boucas

Chile

Kegan S.A.C.
Casilla 2483
Santiago de Chile

Tel. 896 37
Tx. 94829

Mr. Angel Sanhueza
Mr. Luis Herman

Denmark

W.J. Christensen Jylland A/S
Nordlandsvej 64 - 66
8420 Risskov

Tel. (03) 21 43 11

Mr. E. Thor Christensen

W.J. Christensen A/S
Praestefaelledvej 16
2770 Kastrup

Tel. 51 23 11

Mr. Henning Lorentzen

Finland

Auraprint Oy
Box 131
(Akselintie 5)
20101 Turku 10

Tel. 30 31 33
Tx. 62353

Mr. Mauri Taivalkoski

France

Hervé et Fils SA
90 Bd. de la Villette
75019 Paris

Tel. 208 32 20
202 27 72
Tx. 670323

Mr. Jacques Hervé
Ms. Madeleine Gaydou

Great Britain

Petty Business Forms Ltd.
Whitehall Road
Leeds LS12 1BD

Tel. 38953
Tx. 55480

Mr. Keith Benson
Mr. Brian Gray

Waterlow Security Printers Ltd.
Caleb Close
Dunstable Road
Luton LU4 8DR

Tel. 50 53 33
Tx. 8953573

Mr. Michael J. Keeling

B.P.C. Business Forms Ltd.
P.O. Box 10
(George Street)
Dunstable LU6 1NW/Beds

Tel. 582 642 00
Tx. 825283

Mr. Roy F. Smith

Holland

De Blaeuwe Werelt B.V.
Postbus 1089
Wilmerdorf 49
7327 AD Apeldoorn

Tel. (055) 4153 55
Tx. 36437

Mr. Jos van der Vorst

Iran

Formsaz Co. Ltd.
Vila Ave.
Alaei Couche No. 260
Teheran

Tel. 82 62 65
Tx. 213702

Mr. Rahim Seiraffi

Israel

Oniyah Dr. W. Riese & Son Ltd.
P.O. Box 1700
(10 Derech Hashalom)
Tel Aviv 61000

Tel. 33 22 71
Tx. 32153

Mr. Kurt Riese
Mr. Levi Yariv

Italy

Modul Multipli Industria Grafica
Via XX Settembre 25
20024 Garbagnate Milanese

Tel. 995 50 40
995 64 84

Mr. Felice Nazzari

Turati Lombardi e C.S.p.A.
Viale A. Fillipetti 9
20122 Milan

Tel. 546 26 51
Tx. 333411

Mr. Delo Lombardi
Mr. P.V. Brandolese

Japan

Iseto Shiko Co. Ltd.
2 - 20 Kitakyuhoji
Higashi-ku
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11 C l e a n i n g

11.1 General

The printer cover can be cleaned when necessary.

If dusty:

with dust cloth or brush.

If slightly dirty:

with cloth moistened with soapy water or household washing-up liquid.

If very dirty:

with Freon TF (Du Pont).

Cleansing agents containing alcohol (spirit) may be used.

The space below the two cover lids may be cleaned occasionally of paper dust.

Control characters

Print head movement

- ESC [1 w Character spacing 10 (5 cpi)
- ESC [2 w Character spacing 12 (6 cpi)
- ESC [4 w Character spacing 17 (8.5 cpi)
- ESC [8 Expanded print ON
- ESC [n S P E Filler steps ON (n = 1 to 6 decimal)
- ESC [S P E Filler steps OFF (coding switch setting)
- ESC [p 1 ; ... ; p 1 2 q Carriage return (coding switch setting)
- ESC [p 1 ; ... ; p 1 2 q Trip horizontal tabulator (p = 1 to 136 decimal)
- ESC [3 q Clear horizontal tabulator
- ESC [p 1 ; p 2 s Program first and last print position
- ESC [s Delete first and last print position
- ESC [0 Underlining ON
- ESC [9 Underlining OFF

Paper movement

- LF Line feed (coding switch setting)
- ESC [K Half line forward
- ESC [L Half line backward
- ESC [n X Alter line spacing (n/72"; n = 1 to 99 decimal)
- ESC [p 1 ; ... ; p 1 2 r Set vertical tabulator (p = 1 to 99 decimal)
- ESC [V T Trip vertical tabulator (jump)
- ESC [4 q Clear vertical tabulator
- ESC [p 1 ; p 2 { Program first and last print line (p = 1 to 99 decimal)
- ESC [{ Delete first and last print line
- ESC [F F Form feed
- ESC [n p Alter form length (n = 0 to 99 decimal)
- n = 0 makes FF ineffective

Character generator

- ESC (@ International
- ESC (A English
- ESC (B ASCII
- ESC (E Danish/Norwegian
- ESC (H Swedish/Finnish
- ESC (K German
- ESC (R French/Belgian
- ESC (3 Spanish

Graphics printing

- ESC [n y Column by column information entry
- Bit-image method (n = 4 digit decimal)

General

- BEL Bell
- ESC @ Reset printer
- ESC R Reset parameters

Options

- ESC 5 Switchover to loadable character generator
- ESC [t Load loadable character generator
- ESC [1 Character generator 2
- ESC [i Scanner method ON
- ESC [y Bit-image printing similar to "Epson mx82" or as per handy ON
- ESC [~ Scanner method and bit-image printing OFF.

Only performed directly after CR.

ASCII	HEX	DEC	ASCII	HEX	DEC	ASCII	HEX	DEC
BEL	07	7	FF	0C	12	<	28	40
HT	09	9	CR	0D	13	3C	60	
LF	0A	10	ESC	1B	27	5B	91	
VT	0B	11	SP	20	32	{	7B	123

Parallel interfaces

Centronics® (SAP-P1)

Pin X1	Assignment	Pin X1	Assignment
1	STROBE	10	ACKNOWLEDGE
2	DATA 1	11	BUSY
3	DATA 2	12	PAPER END
4	DATA 3	13	SELECT
5	DATA 4	17	CHASSIS
6	DATA 5	18	+5 V
7	DATA 6	31	INPUT PRIME
8	DATA 7	32	FAULT
9	DATA 8		

Pins 14, 16, 19...30 and 33 are connected to 0 V, pins 15, 34, 35 and 36 are not used.

Notes:



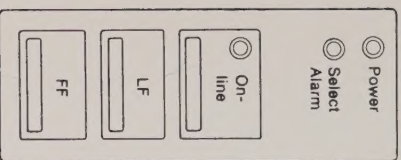
Pushbutton functions

Power switch:



The power switch is at the back of the printer above the power cable socket.

Control panel:



Display illuminated: ac power applied

Display illuminated: data in receive buffer

Display flashes: malfunction (e.g. end of ink/paper)

Display illuminated: ON-LINE mode

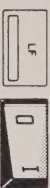
ON-LINE/OFF-LINE mode switchover

Press briefly: Paper feed, single-line*)
Hold down: Continuous feed*)

Form feed*)

*) only effective in OFF-LINE mode.

Test mode activation:



Switch on power while **holding** the LF pushbutton **down**. A print sample consisting of the characters of the character set selected at this time is printed.

Test stop:



Press the FF pushbutton until the printing operation is interrupted at the end of a line.

Test continuation:



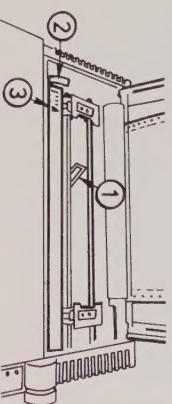
Press the LF pushbutton: the printing operation is continued.

Test mode deactivation:



Switch off power at power switch.

Paper tensioning levers:



① Pressure lever:

– raised for roll paper
– swung down to the left for single sheets and fanfold paper.

② Paper pressure arm closed – pressed to the front released – pressed to the rear

③ Arrow ▲ marks the first print column.

Coding switch

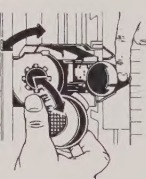
The printer leaves the factory with all switches set to ON.

● = ON ○ = OFF

Switch			Character sets, special characters	
1	2	3		
●	●	●	ASCII	# \$ % & ' () * + , - . / : ;
●	○	○	S/SF	\$ % & ' () * + , - . / : ;
○	○	○	GB	£ ¤ ¥ ¦ § ¨ © ª « ¬ ® ¯ ° ±
○	○	○	E	# \$ % & ' () * + , - . / : ;
○	○	○	IA No. 5	# \$ % & ' () * + , - . / : ;
○	○	○	D	# \$ % & ' () * + , - . / : ;
○	○	○	DK/N	# \$ % & ' () * + , - . / : ;
○	○	○	F/B	# \$ % & ' () * + , - . / : ;

Switch	ON	OFF	Remarks
4	LF = LF	LF = CR + LF	Paper movement
5	CR = CR	CR = CR + LF	
6	even	odd	Parity
7	off	odd	
8	11"	12"	Form length
9	1/6"	1/8"	Line feed
10	PT 88	PT 89	Printing width

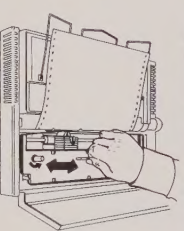
Replacement of the ink cartridge:



Removal of the ink cartridge:
Unlatch ink cartridge by turning it to the left and lift up and out.

Installation of the ink cartridge:
Insert ink cartridge and turn it to the right into the operating position.

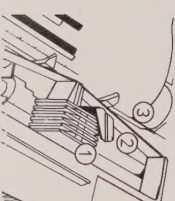
Replacement of the ribbon:



Removal of the ribbon cartridge:
Hold cartridge by handling rib and lift cartridge up and out.

Installation of the ribbon cartridge:
Hold cartridge by handling rib and apply light pressure to snap it into place in the two grooves.
Push ribbon between needle print head and platen with, for instance, a pencil.

Adjustment of the print impact in the needle printer:



Position 1:
larger gap for multi-part paper.

Position 2:
smaller gap for single-part paper.

Position 3:
for removal of the needle print head.

Serial interfaces

(● = ON; ○ = OFF)

Switch S1	110	220	300	600	1200	2400	4800	9600
SAP-S1, SAP-S2	○	○	○	○	○	○	○	○
1	○	○	○	○	○	○	○	○
2	○	○	○	○	○	○	○	○
3	○	○	○	○	○	○	○	○

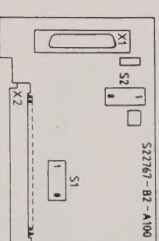
V.28/V.24 or RS-232-C (SAP-S1)

S27167 - B1 - A100		S27167 - B1 - A100		S27167 - B1 - A100		S27167 - B1 - A100	
Pin X1	DIN	CCITT	RS-232-C	Pin X1	DIN	CCITT	RS-232-C
1	E1	101	GND	1	E1	101	GND
2	D1	103	BA	2	D1	103	BA
3	D2	104	BB	3	D2	104	BB
4	S2	105	CA	4	S2	105	CA
5	M2	106	CB	5	M2	106	CB
6	M1	107	CC	6	M1	107	CC
7	E2	102	AB	7	E2	102	AB
8	M5	109	CF	8	M5	109	CF
20	S1.2	108.2	CD	20	S1.2	108.2	CD
25*)	BUSY	---	---	25*)	BUSY	---	---

*) not as per standards given, can be switched to pin 2 and 20

Operating mode	S1			S2				
	4	5	6	1	2	3	4	5
Operation with Signal	D1, D2, S1.2, (BUSY)	○	○					
	D1, D2, S1.2, M1, (BUSY)	●	○					
X-ON/X-OFF protocol	Modem	○	●					
				●	○	●	○	○
BUSY	neg. potential							
	pos. potential			○				●
BUSY (X2,10)	BUSY			○	○	●	●	
	D1			○	○	○	○	○
connected to	S1.2			○	○	○	○	○

TTY 20 mA (SAP-S2)



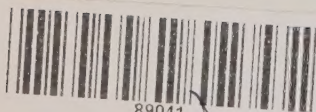
Pin X1	Remarks
1	E1 (101)
9	b1 receive line
10	a1
18	b2
21	a2 send line

Operating mode	S1								S2						
	4	5	6	7	8	1	2	3	4	5	6	7			
X-ON/X-OFF protocol	●	○	●	○	○										
BUSY	○	○	○	○	○										
	○	○	○	○	●										
Internal power source						○	○	●	●	○	○	●			
External power source with protective resistor						●	○	○	○	●	○	○			
External power source without protective resistor						○	●	○	○	○	○	○			

DEZ.	HEX.	ASCII	DEZ.	HEX.	ASCII	DEZ.	HEX.	ASCII
0	00	NUL*	48	30	Ø	96	60	`
1	01	SOH*	49	31	1	97	61	a
2	02	STX*	50	32	2	98	62	b
3	03	ETX	51	33	3	99	63	c
4	04	EOT*	52	34	4	100	64	d
5	05	ENQ*	53	35	5	101	65	e
6	06	ACK	54	36	6	102	66	f
7	07	BEL	55	37	7	103	67	g
8	08	BS*	56	38	8	104	68	h
9	09	HT	57	39	9	105	69	i
10	0A	LF	58	3A	:	106	6A	j
11	0B	VT	59	3B	;	107	6B	k
12	0C	FF	60	3C	<	108	6C	l
13	0D	CR	61	3D	=	109	6D	m
14	0E	SO*	62	3E	>	110	6E	n
15	0F	SI*	63	3F	?	111	6F	o
16	10	DLE*	64	40	@	112	70	p
17	11	DC 1	65	41	A	113	71	q
18	12	DC 2*	66	42	B	114	72	r
19	13	DC 3	67	43	C	115	73	s
20	14	DC 4*	68	44	D	116	74	t
21	15	NAK*	69	45	E	117	75	u
22	16	SYN*	70	46	F	118	76	v
23	17	ETB*	71	47	G	119	77	w
24	18	CAN*	72	48	H	120	78	x
25	19	EM*	73	49	I	121	79	y
26	1A	SUB*	74	4A	J	122	7A	z
27	1B	ESC	75	4B	K	123	7B	{
28	1C	FS*	76	4C	L	124	7C	
29	1D	GS*	77	4D	M	125	7D	}
30	1E	RS*	78	4E	N	126	7E	~
31	1F	US*	79	4F	O	127	7F	DEL
32	20	SP	80	50	P			
33	21	!	81	51	Q			
34	22	"	82	52	R			
35	23	#	83	53	S			
36	24	\$	84	54	T			
37	25	%	85	55	U			
38	26	&	86	56	V			
39	27	'	87	57	W			
40	28	(	88	58	X			
41	29	)	89	59	Y			
42	2A	*	90	5A	Z			
43	2B	+	91	5B	[			
44	2C	,	92	5C	\			
45	2D	-	93	5D	]			
46	2E	.	94	5E	^			
47	2F	/	95	5F	_			

*) The printer's PT 88/PT 89 do not use these control characters.

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89041

Issued by
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Ref. no.: A22761-A88-A1-3-7635

Printed in the Federal Republic
of Germany

AG 09835.0

8/83

035535 H

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